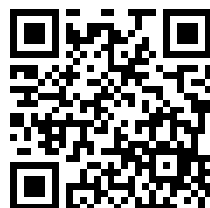


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**Journal**  
**of the**  
**Royal Army Medical Corps**



# Journal

OF THE

# Royal Army Medical Corps

EDITED BY

COLONEL SIR WILLIAM H. HORROCKS, *K.C.M.G., C.B.*

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MONTHLY

EDITOR.

COLONEL SIR WILLIAM H. HORROCKS, K.C.M.G., C.B.

MANAGER.

LIEUTENANT-COLONEL W. J. F. CRAIG, R.A.M.C.

**CONTENTS**

	PAGE		PAGE
<b>ORIGINAL COMMUNICATIONS.</b>		<b>CLINICAL AND OTHER NOTES.</b>	
The Penetration of Rays Through the Skin and Radiant Energy for the Treatment of Wounds. By Sir LEONARD HILL, M.B., LL.D., F.R.S. . . . .	1	Removal of Casualties from a Light Tank (Mark VI). By Captain J. E. ELLIOTT, R.A.M.C. . . . .	45
A Mobile Hygiene Laboratory in Flanders, 1917. By P. R. McNAUGHT, M.D., D.Sc.(P.H.), D.P.H. . . . .	10	A Case of Severe Vesicovaginal Fistula Treated by Ureterocolic Implantation. By Captain A. J. CLYNE, R.A.M.C. . . . .	50
Bacterium Typhosum. By Major H. J. BENSTED, M.C., R.A.M.C. . . . .	19	<b>ECHOES OF THE PAST.</b>	
<b>EDITORIAL.</b>		Twenty Years After. By H. SKIPTON STACY, M.D., Ch.M.(Syd.), F.R.A.C.S. . . . .	52
The Control of Tetanus . . . . .	36	<b>CURRENT LITERATURE</b> . . . . .	61
		<b>REVIEWS</b> . . . . .	63

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**THE PENETRATION OF RAYS THROUGH THE SKIN AND  
RADIANT ENERGY FOR THE TREATMENT OF WOUNDS.<sup>1</sup>**

BY SIR LEONARD HILL, M.B., LL.D., F.R.S.,

*Director of Research, the St. John Clinic and Institute of Physical Medicine.*

ACCORDING to the quantum theory a point source of radiation emits "particles" of energy, called photons, which travel in a vacuum in straight lines uniformly in all directions at the velocity of light; the intensity of such radiation received by a material is inversely proportional to the square of the distance. It is important to remember, then, that halving the distance quadruples the intensity, for example, of an arc light acting on the skin. When the source is large compared to the distance of the receiving material, for example a radium plaque, the law does not apply. The shorter the wavelength according to the electro-magnetic theory the greater the energy of radiation. The interaction of matter and radiation is an atomic phenomenon. An atom is conceived as a nucleus surrounded by electrons spinning in various orbits and bound to it. The energy of short-waved radiation is transferred to electrons which being displaced and being negatively charged attach themselves to other atoms thus forming negative ions, while the atoms deprived of electrons form positive ions. Ionization, so produced, starts chemical reactions, since through thermal agitation and the force of attraction between oppositely charged ions there results the formation of neutral atoms. The tendency of radiant energy is to transform complex into simpler elements or compounds. Through absorption of a small

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<sup>1</sup> Reprinted by kind permission of the Editor of the *Journal of the Royal Society of Arts.*



## 2 *Penetration of Rays and Radiant Energy for Treatment of Wounds*

amount of radiant energy chemical changes may result within the living cell, thereby setting free more energy. Radiant energy is transferred to the cells only by absorption and interaction of radiation with matter. If the cell is transparent to a particular wave-length this has no effect upon it. The retina of the eye has been evolved as a receptor of light radiation, of extreme delicacy, being sensitive to a few quanta of energy, an inconceivably small amount. The realization of the fact that the sense organs have been evolved to put us in relation with the environment enables one to reject all forms of witchcraft such as telepathy, polytergism, and dowsing. There are no mysterious rays producing effects which are outside scientific law and explanation.

The fact that radiation produces in living cells first ionization, then chemical change, and finally alteration in the living state explains the latent time which precedes the effect. For example, sunburn results not at the time but some hours after exposure of the white skin to the midday sun. Be it noted that every ionization of atoms resulting in chemical change need not influence the stability of the living cell. There must be a certain intensity to produce an effect, and weak intensity with prolonged exposure does not give the effect of stronger intensity with shorter exposure. For the cell to be affected there must be penetration and absorption of the radiation and a certain threshold of intensity. The very shortest rays of the sun, which come through the atmosphere, are those which produce sunburn, but this is only superficial, because these short ultra-violet rays have very little power of penetrating the skin and exert their effects, therefore only on the living cells which lie just beneath the horny layer of the epidermis. The skin protects itself by thickening the horny layer. Similarly, protection against visible rays which, reaching the cutaneous blood-vessels are absorbed by the blood, is gained by the brown pigment which forms in the cells of the epidermis as the result of exposure to the sun. The reaction of the living cells of the skin to injury are alike whether produced by a blow, irritant poison, or irradiation; there results a primary active dilatation of the minute blood-vessels of the derma followed by a wider spread flare due to opening up of the arteries, accompanied by œdema, the classical reactions of inflammation. Reflex effects may be evoked by way of the nerves and affect deeper parts, and metabolites, such as histamin-like substances, absorbed from the injured parts, may affect the whole body. Irritation of the skin, however produced, whether by ultra-violet rays, heat, blistering fluid, flaggelation, causes more blood and lymph and leucocytes to be brought to the irritated area, and there takes place absorption of damage products followed by processes of repair. The skin thereby stimulates the immunizing power of the body.

Cosmic rays coming from the universe, gamma rays from radium, X-rays, ultra-violet, visible and infra-red rays, and "ultra-short" waves used in radio, form one continuous spectrum of electro-magnetic waves, the various regions of which differ only in wave-length, the cosmic, gamma, and hard

X-rays, being inconceivably short and the rays used in radio many metres long. Cosmic rays have great power of penetration. Such as are absorbed in the body may expel electrons from atoms, but there is no evidence that they have any appreciable effect. It has been suggested that by action on the reproductive cells, cosmic rays may cause mutations to arise. There is no proof of this, but a certain intensity of gamma and hard X-rays can produce changes in the chromosomes of ova, whence mutations do arise. Cells in a state of division are the ones most sensitive to these penetrating rays. Cancers such as have cells actively dividing are affected more than normal tissues. Hence the use of these rays for treatment of cancer, but large doses produce destruction of normal tissues such as marrow and lymphoid tissue, leucocytes, and epithelial linings, and death ensues. The latent time for signs of damage produced in the skin by X-rays is two to five days, the gamma rays of radium two to three weeks, indicating the time it takes for the secondary changes in the living cells to appear. Workers exposed to X-rays or radio-active substances suffer from dermatitis and cancer may result, as it has, from the accidental leaving of a radon tube in the body. Cancer of the lung occurs in high degree in miners who extract pitchblende, the ore from which radium is obtained. The use of radium for treatment of cancer has resulted in not a few cases in the production of intolerable and unrelievable neuralgia. It is claimed that modern X-ray methods can do all that radium does, and that dosage can be much better controlled. Since the discovery of radium by the Curies, who made not one penny out of its exploitation, enormous sums have been paid to those who have worked radium-bearing ores and placed it on the market for curative purpose, and now, after a study of many years of experience, I myself would choose the knife or X-rays for treatment of cancer. The death-rate from cancer can be lowered by prevention of the disease and by early diagnosis and treatment by these means. Radium is only available for the few. The nation would, I think, be little the worse off if all the radium in the country now buried for security from bombing in deep holes, remained therein. Very big monetary influences will cry out against this.

We all know how X-rays, when used at first by men ignorant of its dangers, produced burns, difficult to heal, and cancer. There has been put on the market apparatus for producing very weak radio-active water to be taken by the mouth or injected under the skin : radio-active pads for external use are also advertised widely. Factory hands have died through licking brushes when applying a luminous radium paint to dials of watches. The dosage of radium to be safe has, then, to be very small. The evidence shows that radium in intensity sufficient to produce an effect is always harmful to living cells. It is claimed, however, that very small concentrations such as exist in some spa waters have a beneficial effect, but there is no evidence that spas with a higher content give better curative results than those with a low one. Radio-active pads on the market contain a little of the crude mineral ore from which radium is isolated. This costs a few pence, but

#### 4 Penetration of Rays and Radiant Energy for Treatment of Wounds

pads are sold for ten guineas, and if electrically heated for twenty guineas. An electrically heated pad which is obtainable from any store for about thirty shillings will give all the curative effect of the twenty-guinea pad. The credulity of people about mysterious ray influences is astonishing, and they ought to be protected from the rapacity of those who take advantage of their ignorance. One kind of fraud is punished severely by the law, and another let go scot free.

Ultra-violet rays, similar in action to that of the shortest rays of the sun, are afforded by carbon arcs and mercury vapour lamps. The former can be reinforced by the use of iron or tungsten in the poles. These rays sterilize the air and the skin surface when in sufficient intensity. Owing to their slight penetration of and absorption in the epidermis, their effect is limited to the living cells therein and the capillary loops of the derma just beneath.

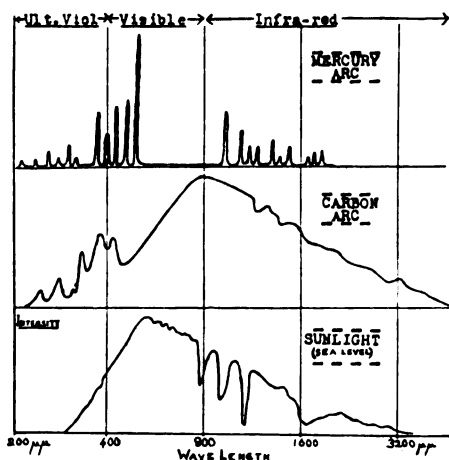


Diagram comparing the distribution of light energy from sunlight, carbon and mercury arcs.

After a latent period of a few hours the skin is reddened, and a fluid and leucocytes infiltrate the exposed area, and if the dose is intense, blistering results. The distribution of blood, lymph, and leucocytes to a wound, and the sterilizing effect has a very beneficial result; the dose must not be made too strong or the healthy granulations will be damaged. By inducing such reactions these rays have the effect of curing carbuncles and boils. To effect this result an intense dose is given to the inflamed area. Similarly, *lupus vulgaris* is cured by the immunizing power of the blood determined to the diseased area by frequent intense doses of ultra-violet rays. The rays can also be used as a blistering agent for relieving sciatica and other painful conditions, elastoplast bandage being applied immediately after irradiation so as to protect the blistered skin and prevent irritation. There are various skin diseases, acne, eczema, alopecia areata, etc., which respond

well to ultra-violet ray treatment. One of the most remarkable actions of the short ultra-violet rays is the production of vitamin D in the skin which is necessary for the growth of bones and protection from rickets. By adequate irradiation, by sun or arc lights and a supply of calcium and phosphorus salts in the diet, rickets can be prevented. Light stimulates breeding in birds, mice, and monkeys, and the introduction in the Zoo of artificial sources of such at my suggestion has made the keeping of tropical birds, lizards, monkeys, etc., easy. That great pioneer Bernhard of St. Moritz at the beginning of this century began to use light and open air for treatment of wounds, and showed in the Great War how it was possible to conserve severely injured limbs which would have been amputated by other surgeons. He used a solution of iodine to clean the wounds in all their depths and ramifications, and then exposed them to sun and air by

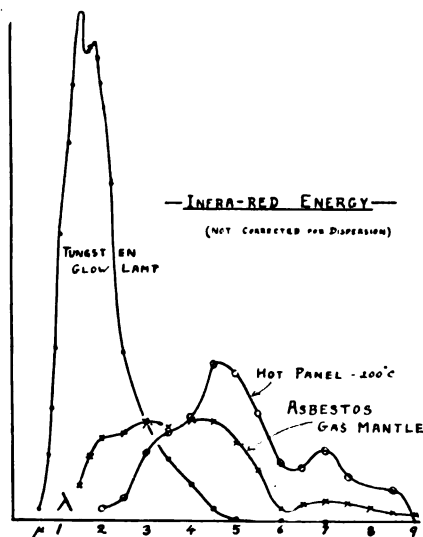


Diagram comparing the amount of infra-red energy from various sources.

day, covering them with a layer of gauze by night. To keep flies off, a covering net was used. Losing no lives from tetanus or gangrene he secured the healing of dreadful wounds. All that he did at St. Moritz can be done here by means of artificial sources of radiation, but our surgeons remain indifferent.

Bernhard uses Light Treatment for the following<sup>1</sup> :—

Traumatic wounds in which primary union from the start cannot be expected (gunshot wounds, lacerated and contused wounds).

Varicose ulcers.

Burns, frost-bites, wounds due to corrosives, X-ray burns.

<sup>1</sup> "Light Treatment in Surgery," by O. Bernhard, translated by R. King Brown. Arnold.



## 6 *Penetration of Rays and Radiant Energy for Treatment of Wounds*

Infected wounds, whitlows, carbuncles, abscesses.

Osteomyelitis.

Fractures.

He lays stress on the analgesic action of irradiation, on the fact that change of dressing is not required, and the economy of the means employed.

The short infra-red and red rays are of particular value as well as the ultra-violet rays. How far the red rays penetrate can be seen by putting a glow-lamp in the mouth in a dark room in front of a mirror, when a faint red glow will be seen to come through the cheek of a white, but not through that of a black man. Irradiation, by bringing blood into a painful part and warming and relaxing the tissues, lessens tension of the nerve-endings and relieves pain. The pain that may follow extraction of a tooth can be relieved, for example, by irradiation of the gum. For painful fibrositis, rheumatic affections of joints, lumbago, the pain accompanying herpes zoster, etc., radiant heat is most effectual.

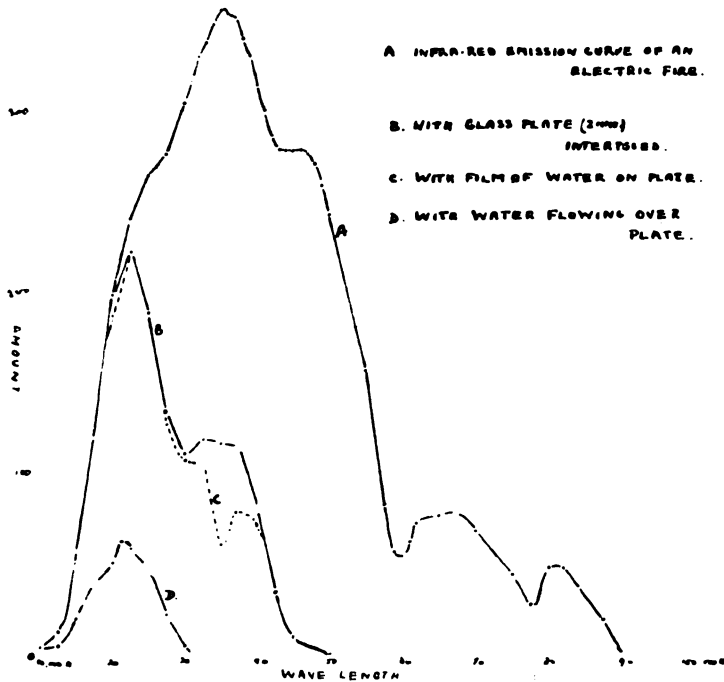
The longer infra-red rays do not penetrate the epidermis, but warm the surface of the skin whence the heat is conducted inwards. It has been claimed that the penetrating red and short infra-red rays coming from luminous sources heat the subcutaneous layer even more than the surface, but researches now being carried out by Dr. H. J. Taylor and myself show that a very sensitive thermo-electric junction introduced as a needle into the substance of the epidermis is, in fact, heated a little more than a similar junction inserted subcutaneously beneath the derma. In the case of a dark heat source, the

*Table showing Temperature of Various Parts of a Rabbit when exposed to a Carbon Arc and in a Cool Room.*

Condition	Region	Temp. °F.
Head exposed to carbon arc (50 mins.)	Fur	142.0
	{ Under skull	107.0
	{ In brain	105.5
	{ Rectum	101.5
In cool room (2 hours)	{ Fur	79.0
	{ Brain	95.0
	{ Rectum	96.0

rays of which are non-penetrating, the surface is heated notably more than the subcutaneous tissue. I have made the discovery that dark sources of heat such as steam pipes, stoves, and dull red sources, such as electric fires, by reflexly causing congestion of the mucous membrane of the air passages of the nose and lungs, tend to narrow these. Bright luminous sources have the opposite effect, the greater comfort of such sources felt by many people being thus explained. The stuffy feeling of warm rooms is due largely to the character of the radiation. The stuffy feeling in crowded rooms has nothing to do with the chemical quality of the air, neither the carbon dioxide being increased nor oxygen diminished sufficiently in such rooms to have the least physiological effect. Ventilation by cool air counteracts the stuffy effect of long infra-red rays. A greenhouse heated by the

sun feels stuffy compared with the open air, because the sunlight is absorbed by the objects within and turned into dark heat, and this is trapped by the glass, while there is no movement of cool air. My work has been confirmed by W. A. R. Thomson and by Dutch and German research workers. It has been shown by the last that dark heat rays also cause a reflex dilatation of skin areas other than that irradiated, while bright sources have the opposite effect. The difference is to be ascribed to the greater warmth of the surface of the skin produced by the dark heat sources. By acting on the epidermic nerve-endings this surface warmth produces the reflex effects. It is claimed that 1 millimetre of flesh is penetrated by 0.5 per cent of the



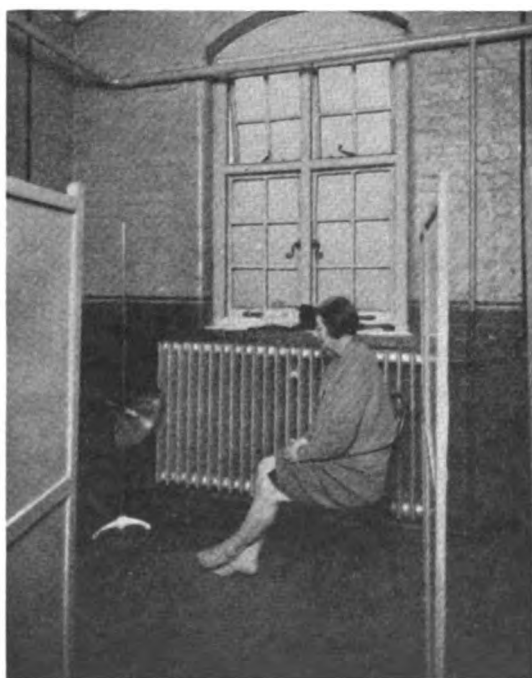
Infra-red emission spectrum of an electric fire.

rays from a dark heater, 15 per cent of those from a carbon arc, and about 30 per cent of those from a tungsten arc or the sun. The visible rays apart from the red are absorbed by the blood in the derma and warm this, the heat being circulated over the body.

While radiation treatment of wounds can be carried out by a mercury vapour lamp in combination with a ring of incandescent lamps, or by infra-red lamps alone, one of the best methods of applying heat to painful parts is by a wax bath at 130° F. The melted wax solidifies at skin temperature and forms a glove on the submerged part of the body, which protects the skin from over-heating, the vapour of sweat under the glove acting as an insulator. The part becomes flushed with blood bathed in transuded fluid

## 8 *Penetration of Rays and Radiant Energy for Treatment of Wounds*

and raised in temperature. The whole body may be heated up a degree or two by immersion in the wax bath of the legs up to the knees. To chilblains, aching feet, and rheumatic pains, the wax bath gives great relief. I call attention to the fact that a dark electric heater was not long ago put on the market and advertised very widely and sold for ten guineas. The advertisement claimed that this heater gave off curative rays of a wave-length which corresponds in fact to rays coming from objects colder than the body ! The claim for the penetrating power of rays from this heater was based on the fact that after half an hour's irradiation there was some evidence of heat having passed through a beef steak. There would, of course, be some conduction of



Patient receiving radiant heat from clinical gas lamp.

heat from the warmed surface. Such a source is no better than an ordinary electric bowl heater which can be purchased at a store for, say, 15 shillings. Electric heaters placed on silver-plated stands and made of impressive shape are sold for many guineas for treatment purposes, when an ordinary electric or gas heater gives just as good results. At my suggestion an infra-red source, of an effective and economic pattern, has been made to run on gas. There is a disc made of a radiating material which gives off a fair percentage of short infra rays heated to incandescence by a bunsen flame ; the rays are concentrated by a concave metal reflector. The rays from such a source can be kept on as long as the patient likes, the intensity of course being such as

not to burn him. For inflammatory conditions such prolonged irradiation is of great value.

Beyond the infra-red rays are those long-wave lengths which are used in radio. The invention of the short-wave vacuum tube oscillator has allowed us to study what are called " ultra-short " waves, but it is not possible as yet to generate any intensity of wave-lengths less than one metre. The " ultra-short wave " instrument giving a wave-length of six metres puts the living tissues placed in the field between condenser plates into electrical stress, the electrons of atoms being driven first one way and then the other. This results in heating of the tissues. Artificial fever can be produced by putting the whole body with the exclusion of the head in the field ; the temperature can be raised even to 105-106° F. in an hour or so. Great care has to be taken of the patient. Gonococcal infection is thus destroyed, while general paralysis of the insane can be treated successfully by this method in place of the induction of malarial fever. Local heating can be produced by placing the electrodes (not touching) on either side, for example of the face, and the temperature of the mouth and nose raised thereby to 101-102° F. in some twenty minutes. Similarly the rectum, and the urine in the bladder, may be heated by placing the electrodes on either side of the hips. This shows how the heating effect penetrates through the body in contrast to other sources of radiant heat, including diathermic ones with longer wave-lengths such as 300 to 400 metres, which penetrate only a little distance and heat deeper parts, if at all, merely by conduction. The " ultra-short " wave machine affords a new and most valuable method of treating all kinds of inflammation, for example sinusitis, tonsillitis, appendicitis, pneumonia and pleural infection, carbuncles, and inflamed wounds, etc. There is no evidence of any specific effect, as has been claimed, apart from that of heat. Dr. H. J. Taylor and I have shown that infusoria, the living heart, ciliated cells, and muscle nerve preparations of the frog, when put in the " ultra-short " wave-field suffer no change so long as they are kept cold. When allowed to be heated by the field they become affected just as they are by a rising temperature brought about by any ordinary means of heating. Claims are made that an apparatus giving an " ultra-short " field too weak to have any heating effect, exerts a beneficial effect on patients. The power of suggestion must be taken into account. Thus, for example, almost any new form of treatment will relieve asthmatics for a time. The psychological effect of suggestion is the main stock-in-trade of quack remedies, while nature cures many ills.

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## A MOBILE HYGIENE LABORATORY IN FLANDERS, 1917.

By P. R. McNAUGHT, M.D., D.Sc. (P.H.), D.P.H.

*Medical Officer of Health, City of York.*

### THE LABORATORY.

THE mobile laboratory built on a three-ton Daimler motor chassis was fitted out with all the equipment necessary for routine chemical and bacteriological examinations, the combined weight being five tons. Photographs of the exterior and the interior of a mobile laboratory may be seen on pages 11 and 12 of Volume I, *Hygiene of the War*, in the official "History of the Great War, Medical Services."

Taken over in London by the writer in November, 1916, the laboratory was shipped with three others of a similar type to Rouen. The laboratories were parked temporarily at the Convalescent Depot south of the city until required for service, and from time to time as the need arose they were despatched to various destinations in France, this laboratory (No. 23 Hygiene) being the last to receive orders to move.

The morning of June 19, 1917, saw us setting out for Abbeville, the next day St. Omer was reached, and the journey ended on the 21st when the laboratory was parked in the yard of a school in the Rue du Bassin, Poperinghe, to the west of Ypres. The area to be worked from Poperinghe comprised the portions of Belgium and France occupied by the Fifth British Army commanded by General Gough. There followed a strenuous week occupied in unpacking, making up media, and fitting up a room in the school as a workplace.

### THE WORK OF THE LABORATORY.

From June 19 until December 17, when the laboratory was ordered to join the British Forces in Italy, a succession of water samples collected personally, or forwarded, were dealt with, varied by such miscellaneous tasks as the examination of two samples of tea, thought to contain an excessive amount of tannin and hence believed to be the cause of constipation amongst the troops (only 6 per cent in one sample and 8.4 in the other was found, both being within the normal 6 to 12 per cent tannin), rice, which proved to be overgrown with *aspergillus* and other moulds, lime juice to calculate the amount of sugar and water to be added to render palatable, tinned herring in tomato sauce, also pork and beans (tins blown—numerous organisms present on culture), a soda water which was satisfactory on

<sup>1</sup> Summary of Dr. McNaught's Presidential Address to the Yorkshire Branch of the Society of Medical Officers of Health, 1938-39. Reprinted from *Public Health*, by kind permission of Dr. McNaught.

chemical examination but had been made from a water impure bacteriologically, and tablets found at a well in the forward area. The latter (possibly of German origin) appeared to consist of acid sodium sulphate with an aromatic flavouring substance suggesting a pine-oil derivative and were reported on as probably water-sterilizing tablets.

Another sample was that of green camouflage material which had been used to cover water tanks in the forward area. After soaking in water, the green colouring matter detached was examined, but was not found to contain any poisonous metals. It was advised that the material should not be allowed to dip into the tanks. A white powder submitted proved to be only sodium bicarbonate. Lastly, a tin of "Pure Cream Butter—extra choice variety" was forwarded as the contents appeared rather waxy and had a peculiar taste and odour like tallow. Analysis gave the figures: Water 9.5 per cent, fat 8.21, curd 1.5, ash 3.7, salt 2.7, and as only 0.27 per cent of boron compounds was found, together with a Reichert-Wollny figure of 25.4 per cent, the butter was pronounced to be apparently free from chemical adulteration. Its taste and odour were ascribed to the presence of (*a*) a small Gram-negative bacillus (which did not ferment sugars) and grew aerobically on agar at 37° C., and (*b*) a short stout Gram-positive bacillus, which grew scantily on agar in anaerobic culture at 22° C., but more plentifully at 37° C.

The chemical and bacteriological methods employed were those in common use in 1914, so far as suitable for a laboratory working in the field. For water analysis Thresh's "Water and Water Supplies" was the standard reference book.

On July 30, 1917, a sample of water drawn from the moat at Ypres was obtained for examination as it was stated that there was a "mustard" or "greenhouse" odour perceptible in the vicinity, and it was suggested that gas might be dissolved in the water. On inquiry it was learned that on July 12 to 13 gas shells had been used by the Germans and that analysis of the liquid filling had shown the presence of 70 to 80 per cent dichlorethylsulphide, with small amounts of hydrocyanic acid and carbon disulphide. No evidence of these was found in the sample of water from the moat.

This was our first introduction to the "blister" gases. With the use of chlorine, phosgene and tear gases in the forward areas, we had already become familiar. Now we found there would be others to deal with and were accordingly on the look-out for new ones, with amusing results. Soon after a shell burst in a part of the town near the laboratory and the explosion was followed by the most abominable and persistent stench. Respirators were hastily donned and investigation of the "new gas" was set afoot. The mystery was solved when it was discovered that a large and well-filled cesspool in the neighbourhood of the laboratory had been blown up and the decomposing contents scattered far and wide.

On another occasion a complaint was received from the inhabitants of the village of Buyssechre that certain wells had been poisoned. On taking

a sample I found that the water on standing showed at the surface an oily film smelling of cresol. Disinfectant had been poured down the drains of some of the houses by troops billeted in them and the cesspools had leaked into the wells and contaminated the village water supplies.

#### WATER SAMPLES.

Examination of water samples formed the bulk of the work. These were obtained from (a) shallow wells, (b) deep wells, and (c) streams over a strip of country extending from the forward trenches occupied by the troops attacking the Passchendaele ridge, through the devastated region of mud and water-filled shell-holes encircling Ypres to the less disturbed country in the vicinity of Poperinghe, back to the district of St. Omer.

Weather conditions, speaking generally, were fine until the end of July, when there came a change with heavy rain. This coincided with the opening of the British push towards Passchendaele and an advance to the Steenbeek. The forward area quickly became a quagmire. The autumn also brought much rain. Earlier samples were thus taken under dry conditions, but later in wet weather.

*Geology of the Area.*—The predominating feature of the area is the very thick “Ypresien” deposit of clays corresponding in age to the London clay and thus of lower Eocene age. Beneath are sandy “Landenien” deposits, the equivalent of the English Thanet beds. Those in Belgium are of the greensand or glauconitic type and were reached in the wells at 400 to 500 feet depth.

#### *Results of Analysis.*

*Shallow Wells of Ypres or Forward Area.*—Nine samples from the area lying to the north-east of Ypres, between the Yser Canal and the Steenbeek, were examined. The soil had been thoroughly churned up by three years of bombardment and in many places was a morass of sticky mud reminding one of an uncooked Christmas pudding, in which the bodies of men, animals, unexploded shells, and other miscellaneous débris took the place of fruit and formed the only stepping stones by which access could be gained to the wells. Pools of muddy and filthy water were all around, and as one would expect there was pollution of the wells to an extreme degree.

To the naked eye most samples presented a more or less turbid appearance, the colour varying from “almost colourless” and “pale straw” to “dark brown.”

An offensive odour was detected in the water from Civilization Farm, and a microscopic examination of the sediment showed the presence of macerated organic matter in which cotton fibres could be recognized. Excluding this sample which gave the extraordinary figure of 3 parts per 100,000 free and saline ammonia, the average was 0.458 part or one hundred times the figure for a fairly satisfactory water.

Albuminoid ammonia ranged from 0.018 (well in a mine tunnel) to 0.5,

the average being 0.173 part per 100,000, seventeen times more than found in peaty waters. Oxygen absorbed from potassium permanganate in two hours varied from 11.2, an average figure for crude sewage, to 1.2. Total solids reached the highest at Below Farm, 400 per 100,000.

Chlorine in parts per 100,000 averaged 27.4 and varied from 65 to 2.5. Nitrates reached 20 per 100,000 at Below Farm, possibly due to pollution by the decomposition products of an explosive; at Venheule Farm 12 parts were recorded. Iron 2.2 parts were found in one sample. Considerable amounts of magnesium salts were present in one sample, sulphates being recorded as 21 parts.

Bacteriological examination showed lactose fermenters absent in 0.1 millilitre and 0.2 millilitre, but present in 0.5 millilitre and higher amounts in one sample from Houthoult Forest. In all the other samples lactose fermenters were present in 0.1 millilitre and larger quantities.

In the vicinity of Ypres most samples were turbid or opalescent; one showing a deposit, not only of quartz, mica and vegetable debris, but also of glauconite. Magnesium and other sulphates reached 32 and 33 parts in two specimens, with chlorine figures of 44 and 22 and total solids of 280 and 210, hardness of 54 and 44, suggesting origin from London clay deposits (Ypresien). Nitrates or nitrites were present in every sample.

In all cases bacteriological findings were unfavourable, lactose fermenters being found constantly in 0.1 millilitre. To the east and south-east of Ypres samples were taken in dug-outs, the fourth specimen being from a steel-lined well about 90 feet deep in Larch Wood. These were apparently less polluted than specimens from the more northern sectors.

Chlorine figures were comparatively low, only 4.8 at Fosse Wood. The oxygen absorbed reached only 0.072 at Railway Wood. The presence of iron was noted in proportions of 1 to 2 parts per 100,000.

All the specimens gave similar results bacteriologically, lactose fermenters in 0.1 millilitre and larger amounts.

#### AVERAGES FOR YPRES SERIES (18 SAMPLES).

Ammonia (free and saline) .. .. .	0.246
Ammonia (albuminoid) .. .. .	0.126
Oxygen absorbed .. .. .	1.07
Solids (total) .. .. .	150
Hardness (total) .. .. .	27.6
Chlorine as chlorides .. .. .	21.7

Let us compare certain of the foregoing figures with those which have been suggested as standards for a "good sewage effluent."

	Ypres wells	"Good sewage effluent"
Free and saline ammonia .. .. .	0.246	1.50
Albuminoid ammonia .. .. .	0.126	0.15
Oxygen absorbed .. .. .	1.07	1.50
Chlorine .. .. .	21.7	10.0

Certain figures (ammonia and oxygen absorbed) for Ypres waters are



rather better than those for a good sewage effluent ; on the other hand chlorine is doubled. Little can be said in their favour as potable waters.

The sample from Civilization Farm can be compared only with average figures for "crude sewage."

					Civilization Farm water	"Crude sewage"
Free and saline ammonia ..	..	..	..	..	3.0	6.5
Albuminoid ammonia ..	..	..	..	..	0.5	1.5
Oxygen absorbed ..	..	..	..	..	11.2	10.0
Chlorine ..	..	..	..	..	55.0	10.0

Note that its chlorine figure is five and a half times that of crude sewage.

*Shallow Wells of Poperinghe or Mid-Area.*—The waters of the second or Poperinghe group may be arranged under three heads : (1) Three samples from Vlamertinghe, east of the town on the road to Ypres ; (2) four from the districts to the north and east ; and (3) five from the town itself.

(1) The appearance varied from clear and bright to slightly turbid, free and saline ammonia from 0.0008 to 0.06, albuminoid ammonia 0.028 to 0.105, oxygen absorbed 0.09 to 0.26, total solids 26 to 50. The water from the Château had been treated by a water-sterilizing plant and no lactose fermenters were found in 50 millilitres of the water. The number of organisms on gelatine was 480, on agar 37.

(2) The chemical results of the samples showed less wide variations than met with in general. The bacteriological results of one set of samples were similar and good—no lactose fermenters in 50 millilitres, while others showed fermenters present in 0.1 millilitre and upwards.

(3) Of five samples from Poperinghe itself, two were clear, one opalescent, one turbid with whitish deposit, and one had a violet tinge, which proved to be pigment in a growth of algæ.

Free and saline ammonia ranged from 0.01 to 0.08, albuminoid from 0.015 to 0.06, oxygen absorbed from a low figure of 0.003 to 0.58.

Nitrates or nitrites were found in several samples. Lactose fermenters were present in amounts of 0.1 millilitre upwards, except in the 12-feet deep well to the south-west of Poperinghe where the fermenters were absent in 0.1, 0.2, and 0.5 millilitre, but present in 1 millilitre upwards.

#### AVERAGES FOR POPERINGHE SERIES.

Ammonia (free and saline) ..	..	..	..	..	0.026
Ammonia (albuminoid) ..	..	..	..	..	0.045
Oxygen absorbed ..	..	..	..	..	0.23
Solids (total) ..	..	..	..	..	65
Hardness (total) ..	..	..	..	..	17.2
Chlorine as chlorides ..	..	..	..	..	9.5

*Shallow Wells of St. Omer, Western or Base Area.*—The Western group may be divided into three sets, namely (1) three from the district to the west of Poperinghe, (2) six from the area round the north of Cassel, and (3) five samples taken from wells north-west of St. Omer.

(1) The samples did not differ greatly in certain respects, free and saline ammonia ranging from 0.001 to 0.003, albuminoid from 0.012 to 0.025, oxygen absorbed from 0.26 to 0.37.

Chlorine, however, varied from 1.6 to 8. One well showed lactose fermenters absent in 50 millilitres though the growth on gelatine gave 22,400 per millilitre and on agar 8,000 per millilitre.

Two samples showed lactose fermenters present from 0.1 millilitre upwards.

(2) Of the six specimens from Cassel district one was that smelling of cresol as previously related. Its ammonia and oxygen absorbed figures were high; bacteriologically it was bad—285,000 organisms on gelatine and 153,600 on agar. Vegetable débris was present in three samples and specimens of cyclops in two.

(3) The last group of samples from St. Omer neighbourhood contained one which was turbid with vegetable débris and fair numbers of cyclops.

Free and saline ammonia varied from nil to 0.029, albuminoid from 0.004 to 0.22, oxygen absorbed from 0.02 to 0.33. The lowest chlorine figure was 4.5; the highest 9 parts per 100,000.

Some waters contained lactose fermenters in 0.1 millilitre upwards, while others showed these absent in amounts below 10 millilitres. One sample gave only 2,400 organisms on gelatine and 400 on agar.

Omitting the Buysseure specimen contaminated with cresol we get the following figures :—

AVERAGES FOR ST. OMER OR BASE SERIES.

Ammonia (free and saline)	..	..	..	..	0.019
Ammonia (albuminoid)	..	..	..	..	0.036
Oxygen absorbed	..	..	..	..	0.16
Solids (total)	..	..	..	..	53
Hardness (total)	..	..	..	..	15.0
Chlorine as chlorides	..	..	..	..	5.3

*Deep Well Waters.*—So far these notes have related to shallow wells. There was also dealt with one sample from a well at Houkerque, sunk through superficial strata and Ypresien clay, striking the Landenien greensand at 370 feet and of a total depth of 399 feet.

This specimen, though taken from the settling tank, was still turbid, the deposit giving evidence of the presence of glauconite. Its free and saline ammonia was low, 0.003, while albuminoid ammonia reached 0.01. Oxygen absorbed was high at 0.6. Total solids figure was 110. The water was not hard, only 5.8, and chlorine 17.6, was typical of a greensand water. No nitrates or nitrites were found.

Pollution of the tank by dust was probable, the number of organisms on agar being 4,700 and on gelatine 40,000. Lactose fermenters were found in 10 millilitres and upwards but not in 1 millilitre or smaller amounts.

During the period September 12 to November 24 nine samples were taken at the Laiterie, Poperinghe, from "Gough's Well," about 500 feet deep and sunk to the greensand.

rather better than those for a good sewage effluent ; on the other hand chlorine is doubled. Little can be said in their favour as potable waters.

The sample from Civilization Farm can be compared only with average figures for " crude sewage."

					Civilization Farm water	"Crude sewage"
Free and saline ammonia ..	..	..	..	..	3.0	6.5
Albuminoid ammonia ..	..	..	..	..	0.5	1.5
Oxygen absorbed ..	..	..	..	..	11.2	10.0
Chlorine ..	..	..	..	..	55.0	10.0

Note that its chlorine figure is five and a half times that of crude sewage.

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Ammonia (albuminoid) ..	..	..	..	..	0.045
Oxygen absorbed ..	..	..	..	..	0.23
Solids (total) ..	..	..	..	..	65
Hardness (total) ..	..	..	..	..	17.2
Chlorine as chlorides ..	..	..	..	..	9.5

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Omitting the Buysscheure specimen contaminated with cresol we get the following figures:—

AVERAGES FOR ST. OMER OR BASE SERIES.

Ammonia (free and saline)	..	..	..	..	0.019
Ammonia (albuminoid)	..	..	..	..	0.036
Oxygen absorbed	..	..	..	..	0.16
Solids (total)	..	..	..	..	53
Hardness (total)	..	..	..	..	15.0
Chlorine as chlorides	..	..	..	..	5.3

*Deep Well Waters.*—So far these notes have related to shallow wells. There was also dealt with one sample from a well at Houkerque, sunk through superficial strata and Ypresien clay, striking the Landenien greensand at 370 feet and of a total depth of 399 feet.

This specimen, though taken from the settling tank, was still turbid, the deposit giving evidence of the presence of glauconite. Its free and saline ammonia was low, 0.003, while albuminoid ammonia reached 0.01. Oxygen absorbed was high at 0.6. Total solids figure was 110. The water was not hard, only 5.8, and chlorine 17.6, was typical of a greensand water. No nitrates or nitrites were found.

Pollution of the tank by dust was probable, the number of organisms on agar being 4,700 and on gelatine 40,000. Lactose fermenters were found in 10 millilitres and upwards but not in 1 millilitre or smaller amounts.

During the period September 12 to November 24 nine samples were taken at the Laiterie, Poperinghe, from "Gough's Well," about 500 feet deep and sunk to the greensand.

Specimens taken direct from the freshly pumped water before settling were opalescent or turbid. On settling they became clear and bright and a grey-green deposit of quartz, ferro-magnesian minerals, and glauconite, was thrown down.

Free and saline ammonia varied from 0.018 to 0.06, albuminoid from 0.0004 to 0.07, an extraordinary range in amount. Oxygen absorbed highest figure was 0.25 and lowest 0.008. The figure for total solids lay usually in the region of 110 to 120, but on one occasion it fell to 40 and on another rose to 130. Hardness was from 2 to 8. Chlorine was very constant between 26.5 and 28. Only a trace of nitrates was found on one occasion. The residue contained much sodium carbonate.

Bacteriologically the worst specimen showed the presence of lactose fermenters in 0.1 millilitre upwards, and the best, absence in 0.1 millilitre, 0.2 millilitre, 0.5 millilitre, and 1.0 millilitre, presence in 10 millilitre upwards. Averages worked out for the series of nine tests :—

Ammonia (free and saline)	..	..	..	..	0.039
Ammonia (albuminoid)	..	..	..	..	0.019
Oxygen absorbed	..	..	..	..	0.09
Solids (total)	..	..	..	..	110
Hardness (total)	..	..	..	..	3.6
Chlorine as chlorides	..	..	..	..	27.3

*Water Samples from Streams, Rivers, Canals, and Lakes.*—These samples were taken over the area extending from the Steenbeek sector to the east of Ypres, occupied by the front line troops to the Canal de la Colme and the Canal de l'Aa, north of St. Omer at the base.

After the period of heavy rainfall which held up the British offensive in August, the water from the Steenbeek was very turbid and threw down a clayey deposit. There was a moderately high free ammonia 0.01, while albuminoid reached 0.25 and oxygen absorbed was very high at 2.3. Chlorine figure was 3.6. Note that iron was present 12 parts per 100,000, possibly due to the enormous amount of metal débris from exploded shells and other war material.

Two samples from Bellewards Lake gave 0.35 and 0.248 parts free ammonia, albuminoid 0.097 and 0.136.

Next came a series of water samples from the moat surrounding Ypres and from the Yser Canal to the north of the town. Some were fairly clear, others opalescent or turbid and brownish in colour. Averages for the series worked out as follows :—

Ammonia (free and saline)	..	..	..	..	0.069
Ammonia (albuminoid)	..	..	..	..	0.099
Oxygen absorbed	..	..	..	..	0.48
Solids (total)	..	..	..	..	48
Hardness (total)	..	..	..	..	8.7
Chlorine	..	..	..	..	8.1

Further west four samples were taken from Dickebusch Lake and one from its effluent stream the Dickebuschbeck near the Ypres laundry. The

average of the four lake tests is here set out in contrast with the result of analysis of the stream :—

					Lake	Stream
Free and saline ammonia	..	..	..	..	0.032	0.006
Albuminoid ammonia	..	..	..	..	0.087	0.068
Oxygen absorbed	..	..	..	..	0.69	0.69
Solids (total)	..	..	..	..	20	20
Hardness (total)	..	..	..	..	6.4	7.0
Chlorine	..	..	..	..	2.9	1.6

The stream, in addition to the outflow from the lake, received water of obviously purer character from streamlets and springs. The lake was used as a source of supply by the British forces; the water was chlorinated before use for drinking.

Two samples from the neighbourhood of Poperinghe illustrate clearly pollution derived by the water in its passages through a populous place from which surface washings have entered :—

					Vleterbeek	Canal
Free and saline ammonia	..	..	..	..	0.04	0.27
Albuminoid ammonia	..	..	..	..	0.032	0.17
Oxygen absorbed	..	..	..	..	0.38	0.79
Solids (total)	..	..	..	..	40	50
Hardness (total)	..	..	..	..	12.5	11.5
Chlorine	..	..	..	..	3.3	5.2

The Eybecque, the boundary stream between France and Belgium, had been used as a source of drinking water for horses, and this supply was suspected to have produced colic in these animals.

With free and saline ammonia 1 part per 100,000, albuminoid 0.1 part, oxygen absorbed 2 parts and chlorine 5.4, it gave a result approximately equivalent to a mixture of 2 parts of sewage to 1 part of pure river water. One therefore did not rule it out as a possible source of colic !

Last of all are the two samples from the Canal de l'Aa, St. Momelin, and the Canal de la Colme at Schapstadt, north-west of St. Omer.

These canal waters were relatively pure, 0.006 and 0.004 part of free and saline ammonia and only in the Canal de la Colme was the albuminoid figure high. Oxygen absorbed was not excessive, 0.42 and 0.38.

Note also, nitrate 0.01 in the Aa, but chlorine was only 2.5 and 2.6. Bacteriological results were, lactose fermenters absent in 0.1, 0.2, 0.5 millilitre, present in 1 millilitre (Colme), and absent in 0.1, 0.2, 0.5, 1 millilitre, present in 10 millilitres (Aa).

Compare the averages for (a) these two fairly pure canal waters; (b) the Vleterbeek stream at Poperinghe; (c) the Ypres moats and Yser canal.

Rivers and streams.			Canals, Colme and Aa.	Vleterbeek, Poperinghe.	Ypres moats and Yser Canal.
Free and saline ammonia	..	..	0.005	0.01	0.009
Albuminoid ammonia	..	..	0.023	0.032	0.099
Oxygen absorbed	..	..	0.40	0.38	0.48
Chlorine	..	..	2.45	3.3	5.1

Let us now turn from the demonstration of the increasing pollution of rivers, canals and streams as we pass from the base to the forward area, and compare the results with a summary of those previously obtained from the examination of shallow well waters, again using the three divisions, West (St. Omer), Mid (Poperinghe), and East (Ypres), or respectively base, intermediate and forward areas.

Shallow wells				West or St. Omer area. (Average of 18 samples)	Mid or Poperinghe area. (Average of 12 samples)	East or Ypres area. (Average of 14 samples)
Free ammonia	..	..	..	0.019	0.026	0.246
Albuminoid ammonia	..	..	..	0.036	0.045	0.126
Oxygen absorbed	..	..	..	0.16	0.23	1.07
Total solids	..	..	..	53	65	150
Total hardness	..	..	..	15.0	17.2	27.6
Chlorine as chlorides	..	..	..	5.3	9.5	21.7

This table demonstrates clearly the increasing pollution of shallow wells as we pass from the comparatively undisturbed base area near St. Omer to the devastated area in front of and around Ypres, the scene of so many struggles between opposing armies that the soil had become saturated with decomposing organic material.

It is the hope of the writer that in compiling these notes and adding his comments he may have made some slight contribution to the study of the water supply problems which confront us in peace no less than in war.

## BACTERIUM TYPHOSUM.

### The Development of Vi-Antigen and Vi-Antibody.

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IN a previous communication (Bensted, 1937) a report was made on the laboratory findings in a series of cases of typhoid fever. The report was chiefly concerned with the mouse virulence and Vi-antigen content of the organism recovered from the blood culture and the findings, which were in general agreement with those of other workers, were fully confirmed in the following year in a similar, but more extensive, report by Lewin (1938).

The present communication is concerned with the examination of a further series of strains of *Bact. typhosum*, chiefly with regard to the enhanced development of Vi-antigen, and also an investigation into the production of Vi-antibody in natural infections in man, induced infections in animals and the response following the injections of killed suspensions of certain Vi-strains.

### Vi-content of Freshly Isolated Strains and the Change Induced by Artificial Culture Media.

The antigenic analysis of a further 380 recently isolated strains has since been carried out, and out of this number only four were encountered that appeared to be completely devoid of Vi-antigen. Whilst the remaining 376 cultures were all rich in Vi-antigen there were only 18 that were fully resistant to "O"-agglutination when originally examined. In the report previously communicated 16 per cent of the strains were designated as pure V-forms. At that time, however, it was not fully appreciated the extent to which resistance to "O"-antibody may be influenced by the period of incubation of the cultures. Strains containing minimal amounts of Vi-antigen may appear to be completely "O"-resistant after five or six hours' incubation, whereas after twenty-four hours or more it may be difficult to appreciate more than a trace of Vi and the culture appears to be fully sensitive to "O"-antibody. True Vi-strains remain "O"-resistant after much longer periods of incubation, even when grown on ordinary digest-agar and stock cultures of such strains as Ty. 2, Watson, Raw-Ben, etc., that have been maintained on egg-media, for still longer periods. Growth scraped from the surface of month-old cultures on this medium is fully sensitive to a pure Vi-serum and shows but slight reaction to "O"-antibody. Table I shows the difference in "O"-resistance, according to the length of



incubation, between classical Vi-strains and freshly isolated cultures under test :—

TABLE I.

Strain	Age of culture							
	5 hours		24 hours		3 days		1 month	
	Vi	"O"	Vi	"O"	Vi	"O"	Vi	"O"
Ty. 2 .. ..	++	0	++	0	++	0	++	±
Raw-Ben ..	++	0	++	0	++	0	++	±
T. 240.. ..	++	0	+	++	±	++	±	++
T. 271.. ..	++	0	++	++	+	++	+	++

Amongst the cultures examined there was a batch of 12 that originated from an isolated epidemic in a boarding school where all the pupils were reported fully protected by T.A.B. vaccine. The cases were very severe and two were fatal, yet there was the widest difference in the Vi-content of the cultures recovered from the blood—more marked than Perry, Findlay, and Bensted (1933) found in the Malton outbreak of 1932, even though all cultures from the latter were from faecal isolations. In the epidemic in question cultures from one fatal and one other case appeared to be completely devoid of Vi-antigen, nine contained Vi, but were very sensitive to "O"-antibody, whilst only one was "O"-resistant.

The value of egg-media in the maintenance of Vi-antigen has been appreciated for some time (Kauffmann 1935, Bensted 1937, Felix 1938), and has been employed for that purpose by the present writer since 1933, but this medium would, under certain conditions, appear to have the further power of enhancing the development of the antigen. In January, 1935, a number of typhoid strains were subcultured on to egg-medium in small MacCartney bottles. After the preliminary opening a few weeks later, for examination, several of them remained sealed until the beginning of 1938. Those of special interest were : "T.901 OH," "T.901 O," and the original rough Rawlings, and after three years in a stock-culture box, subjected to a great range of temperatures, between 40° and 120° F., they were sub-cultured on to digest-agar and good growths were obtained after twenty-four hours' incubation.

The old Rawlings strain, which originally contained only a minimum amount of Vi and had an A.L.D. for mice in the region of 400 millions, was now completely "O"-resistant whilst responding very actively to a pure Vi-serum and its A.L.D. for mice was between 50 and 80 million.

Vi-forms have been recovered from "T.901 OH" strains by other workers (Craigie and Yen, 1938), but this was not appreciated when similar results were observed in this laboratory and even more striking was the demonstration of very definite amounts of Vi-antigen in the field cultures of "T.901 O." (This was enhanced after colony selection, but was sufficiently obvious in young field cultures as to put all doubt aside.)

In a previous communication (1937) it was stated that two series of Vi-strains, one "O"-resistant and the other "O"-sensitive, had been seeded on to egg-media and the bottles sealed and set aside for examination at a later date. They have recently been examined after an interval of three years: all the "O"-resistant forms were found to have retained their original properties and Table II illustrates the change that took place in the other series.

TABLE II.

Strain	Result in 1936 with		Result in 1939			
	Pure Vi-serum	Pure "O"-serum	After 24 hours' growth		After 72 hours' growth	
			Pure Vi-serum	Pure "O"-serum	Pure Vi-serum	Pure "O"-serum
V.W. <sub>1</sub> .. ..	+	++	++	0	++	0
V.W. <sub>2</sub> .. ..	+	++	++	0	++	0
V.W. <sub>3</sub> .. ..	+	++	+	+	+	++
V.W. <sub>4</sub> .. ..	+	++	++	0	++	0
V.W. <sub>5</sub> .. ..	+	++	++	0	++	0
V.W. <sub>6</sub> .. ..	+	++	++	0	++	0

It will be seen that one strain has remained "O"-sensitive. This has been noted but rarely. Reversion of stock Vi-strains occasionally takes place also. For instance two one-year-old cultures of Raw-Ben were found to have become "O"-sensitive, yet the original three-year-old stock yielded cultures that were completely "O"-resistant.

Except where stated, colony selection was not employed in any of the work described above; any change in the antigenic structure described was demonstrated in the field-cultures of that particular strain.

In the early part of 1938 Major Bhatnagar kindly sent the writer a subculture of a strain of *Bact. typhosum* that he had received from Europe. This strain, now known as Vi.1, was so deficient in "H" and "O" antigens that suspensions prepared from agar-washings were sensitive only to Vi-antibody. The properties of this variant have been fully described by Bhatnagar (1938), who particularly draws attention to its rough tendency. Nevertheless, in spite of the rough appearance of the colonies, suspensions can be readily prepared that are stable in high concentrations of saline, but constant care must be exercised in subculturing the strain, as is the case with all Vi-stock cultures, to ensure that the new growth retains the full sensitivity and specificity of the parent stock.

The serological behaviour of the new Rawlings strain, known now as "T.R.V.," appeared to be so similar to this Vi.1 strain (the early subcultures failed to react with "H"-antibody) that it was hoped that the two antigens

could be used in parallel for the estimation of Vi-antibody, by a simple direct method. When, however, bulk quantities of "T.RV"-suspensions were prepared it was found that small amounts of "H"-antigen were invariably present and it was, therefore, decided to use the "T.Vi. 1" alone for the time being. The suspensions of the latter organism were prepared by washing off the eighteen hours' growth from saccharose-digest-agar in 1:5,000 mercuric iodide. The saccharose medium gives an excellent growth of bacteria and, although not obviously superior to ordinary digest-agar in the case of other Vi-strains, does appear to be of definite advantage with this particular strain.

The thick creamy washings from as many Roux bottles as are considered necessary are first strained through packed cotton-wool and then diluted down by the addition of further quantities of mercuric iodide to the standard opacity of the "concentrated agglutinable suspension" described by Bridges (1935) and bottled in 5-c.c. quantities. This suspension was given extensive trials in this laboratory and the results were considered sufficiently satisfactory to warrant an experimental issue to a few other laboratories. It was at first prepared in small batches and issued for immediate use only after its agglutinability and specificity, etc., had been tested.

Meanwhile efforts were made to produce a more satisfactory "T.RV"-suspension. Bien and Sonntag (1917) had found that the addition of alcohol to saline suspensions of the "X"-strains of the proteus organisms did not reduce their agglutinability markedly, and they noted that such suspensions retained their properties over long periods. The explanation of the success of this procedure was, of course, partly due to the sterilizing properties of alcohol and partly due to its action, as Craigie (1931) showed, in removing the free part of the flagella so that the non-specific "H"-agglutination did not interfere with the reading of the Weil-Felix reaction. A modification of Bein and Sonntag's technique has been in use for a number of years in this laboratory for the production of pure "O"-suspensions (Bridges, 1935). Felix and Pitt (1934) remarked on the apparent destruction of Vi-antigen by alcohol and recently Felix (1938) stated that whilst alcoholized suspensions of Vi-strains were suitable for the production of Vi-antibody, yet they were insensitive to the action of Vi-agglutinins. This had been our own experience with many strains, but it had been observed that some cultures, even after prolonged contact with alcohol, continued to react with a pure Vi-serum. The original alcoholizing process for the production of "O"-suspensions lasted for twenty-four hours, but recently this period has been very much reduced and at the present time the suspension is shaken in alcohol for half an hour only. It was whilst experimenting with the reduction in time of the alcoholizing process that the stability of certain Vi-cultures towards alcohol was noted. "T.RV" and "T.Vi.1" especially, after several hours in the presence of alcohol, failed to show any reaction with a pure "O" serum. Nevertheless, long contact with alcohol tended to produce suspensions that became granular and auto-agglutinable and occasionally reduced

the Vi-sensitivity and, therefore, as five or ten minutes' shaking with alcohol produced a suspension (in the case of sluggishly motile bacilli) that completely failed to react with a pure "H"-serum, there was everything to be gained by the shorter contact. Also by killing the bacteria very quickly in mercuric iodide before shaking with alcohol the loss of Vi-sensitivity appeared to be reduced to a minimum. It was found then that a pure Vi-suspension of the "RV"-strain could be prepared by washing off the eighteen to twenty hours' growth from digest-agar with 1 : 5,000 mercuric iodide, after about one hour's contact four times the bulk of alcohol is added and the mixture shaken very frequently during the next five minutes. Flocculation takes place rapidly, and generally in less than another five minutes the supernatant alcohol can be removed by a suction pipette. The residue is then centrifugalized rapidly, and the centrifugate, finally drained of alcohol, is re-suspended in 1 : 10,000 mercuric iodide and the opacity standardized to that of the "concentrated agglutinable suspension."

Suspensions prepared in the manner described were found to be as sensitive to Vi-antibody as those of T.Vi.1, yet unaffected by pure "O" or "H" sera, and to be completely stable in all concentrations of saline up to 6.8 per cent.

#### Estimation of Vi-antibody.

Although in the communications of Felix (1938) and Bhatnagar (1938) certain details of method are given, it is thought that a description of the technique employed in this and other military laboratories in India for the past year and more might be of interest.

The reagents employed are the two Vi-suspensions, "T.Vi.1" and "T.RV" described above, and a standardized Vi-serum is also issued in order that Vi-agglutination may be properly appreciated and comparable results obtained. The Vi-serum prepared in this laboratory is very carefully compared with the "provisional standard Vi-serum," kindly supplied by Dr. Felix, by carrying out parallel tests with several batches of "T.Vi.1" and "T.RV" and also Watson suspensions. Unless it gives results of the same order it is not issued. Felix's serum is prepared from the horse and is unpreserved, whereas the serum prepared in this laboratory is a glycerinated rabbit serum. Unpreserved serum is not suitable for general issue in this country owing to the extreme changes of temperature and the ease with which contaminations occur. Glycerinated Vi-serum, prepared over four years ago by the present writer, has retained its original titre although subjected to rough usage and a great range of temperatures.

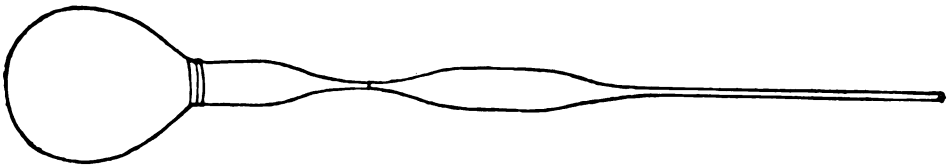
The agglutination tubes are round-bottom test tubes, 2 by  $\frac{1}{2}$  in., and they are arranged in low wooden racks so that each serum can be tested against four antigens, the two Vi-suspensions mentioned above, and also pure "O"-antigens of *Bact. typhosum* and *Bact. paratyphosum* A with which this communication is not directly concerned.

The serum dilutions are carried out by the "doubling dilution" method by means of a volume pipette of the type shown in the diagram below.

The pipette has a capacity of about 0.75 c.c. and is used with a large half-ounce bulb teat that fits comfortably into the half-closed hand. With a little practice long series of accurate deliveries can be made quickly and without fatigue.

In view of the low dilutions employed in the first tube of any series it is essential that the serum should be bright, clear, and entirely free from hæmoglobin.

For the test one volume of saline is first introduced into every tube set out, then one volume of the serum, diluted two and a half times, is pipetted into the first tube of each row. The double volume in the first tube is well mixed by sucking up and down twice in the pipette and then one volume is transferred to the second tube, and so on to the last tube but one in each row. The actual serum dilutions are therefore 1:5, 1:10, 1:20, etc., and the last tube, which contains no serum, is the control. The concentrated



agglutinable suspensions are then introduced by means of a Dreyer standard dropper—one drop into each tube, which represents about one-thirtieth of the final bulk. The rack is shaken as in the Kahn flocculation test, but only for fifteen seconds, and placed in the incubator at 37° C. for two hours, after which it is removed and allowed to remain at standard room temperature until the next morning, when the results are read. As the temperature in several laboratories in India may be over 100° F. for many hours during the day the cool chamber is recommended in such circumstances and has been found to give satisfactory results.

The reading of the test requires considerable care and experience. The first essentials are that the lowest dilutions should show total agglutination with the supernatant fluid clear and that the negative controls should show the unagglutinated bacteria agglomerated in a central mass at the bottom of the tube. The actual end-point, as stated by Felix (1938), is that dilution of serum that produces Vi-agglutination with the Vi-suspensions issued to a degree equal to that given with the titred standardized Vi-serum.

#### Development of Vi-antibody.

*In Individuals Suffering from Typhoid Fever.*—The presence of Vi-antibody in the sera of typhoid patients was recorded by Felix and others (1935), Gundel and Abdoosh (1936), Bensted (1937), and several other workers, but as the demonstration had generally involved the preliminary

absorption of the "H" and "O" antibodies it was hardly a practical proposition for routine work, and as the absorbing agent generally used was "T.901 OH," which frequently contains Vi-antigen also, the estimations would tend to lack accuracy. It is true that Felix employs a direct method that gives excellent results in his hands, but it does not appear to have been used largely by other workers.

With the introduction of killed suspensions that were sensitive only to Vi-antibody it was hoped that its titration might be carried out with reasonable accuracy by the average laboratory worker. A scheme was evolved to enable these determinations to be carried out by a number of laboratories in India, and they were supplied with the materials mentioned in the previous section and also very full instructions. The instructions were supplemented by numerous personal communications and also by the frequent exchange of test sera to ensure the correct standard was being adopted for the reading of the results.

The early results were irregular and of only partial value owing to the inexperience of many of the workers with regard to the new technique and the failure to appreciate the necessity for observing total agglutination in the low dilutions before accepting Vi-agglutination. However, as soon as the standardized serum was taken into general use and its value appreciated the majority of laboratories—as judged from the results of the exchange of sera—were obtaining comparable readings. There was complete agreement about a negative result but there was a tendency to read Vi-agglutination a step too high. This is mentioned in connexion with the report below, which concerns certain Vi-estimations carried out in other laboratories.

Bhatnagar (1938) recorded a series of cases of typhoid fever in which he had found Vi-antibody production very regular. In every case where the causative organism had been recovered from the patient he was able to demonstrate appreciable amounts of Vi-antibody in the blood serum. On the other hand Pijper and Crocker (1939), although employing the method involving the preliminary absorption of "H" and "O" antibody, found the development of Vi-antibody very irregular, and in three out of eight control cases were unable to demonstrate its presence at any time during the illness.

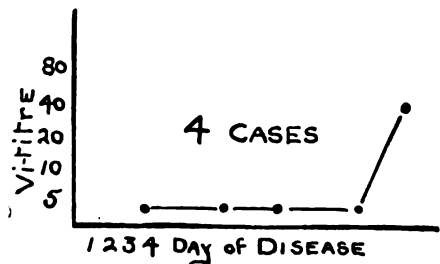
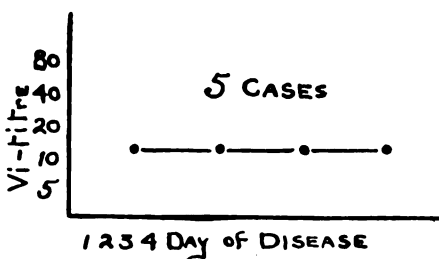
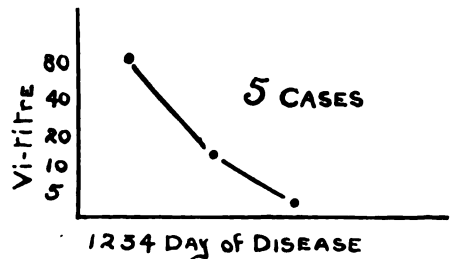
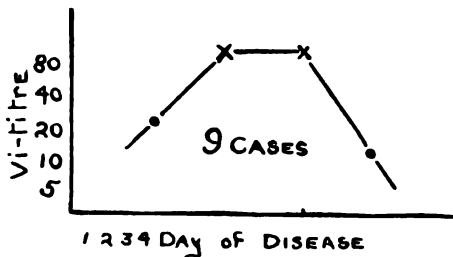
The present report is concerned with the investigation of Vi-development in eighty cases of typhoid fever where the diagnosis was confirmed by the cultivation of *Bact. typhosum* from the blood of the patient. Although a certain amount of the work was carried out in other laboratories the bulk of it was either confirmed or carried out personally.

In 19 out of the 80 patients there was a complete absence of Vi-agglutination in serum dilutions of 1:20 upwards throughout the disease. Of the 19 individuals six were tested at frequent intervals from the third day of onset, whilst in the remainder the first examination was not carried out until the seventh day or a little later. Vi-antibody was demonstrated in the blood-serum of the remaining 61 patients. Appreciable titres were

observed in 18 cases before the end of the first week, and in the remaining 43, the first positive agglutination result at varying times between the eighth and twenty-first day.

19 patients failed to show any Vi-antibody.  
 19 patients showed a maximum titre between 5-40.  
 36 " " " " " " 80-160.  
 6 " " " " " " above 200.

The Vi-agglutinin curve does not appear to follow regular lines, but in 23 patients the following types were encountered :—



In one of the positive cases the titre was 1 : 20 on the seventh day of illness although blood cultures taken on the fifth, seventh, and tenth failed to grow any organisms. The clinical picture for ten to twelve days was that of an almost symptomless pyrexia, but in the third week the patient's condition steadily deteriorated and the picture was typical of enteric. Further blood cultures resulted in profuse growths of *Bact. typhosum*. Although similar cases are met from time to time this is the only occasion on which there has been an opportunity of demonstrating Vi-antibody before the recovery of the organism from the blood has been possible.

With regard to the thirteen cases, examined at intervals after the seventh day without showing the presence of Vi-agglutinins, it is possible that demonstration of this antibody might have been effected had earlier samples of serum been available. Two positive cases had shown appreciable titres, 80 and 160 respectively, before the end of the first week, but by the tenth day the titres had fallen to below 5.

Only 10 of the negative cases were regularly tested in dilutions as low as 1 : 5, and as the titre of one of the positive cases never rose above that figure it is possible that lower dilutions in all the examinations might have disclosed a higher proportion of Vi-agglutinins.

Actually there were five cases, tested in dilutions of 1 : 5 upwards from the third day of onset, that failed to show any Vi-agglutinins. In spite, therefore, of the reservations mentioned above, it would appear that the development of Vi-antibody during an attack of typhoid fever may be so slight that the usual methods employed for its demonstration may fail to establish its presence.

*In Convalescent Carriers.*—Four cases were encountered where the excretion of the typhoid bacillus persisted for more than one month after convalescence was complete. Two of these cases showed a secondary rise in the Vi-titre during convalescence and special precautions were taken in the examination of the stools and urine which resulted in the recovery of *Bact. typhosum* from the stool in each case. The Vi-titre rose to 80 in the first case and remained at that height during the carrying period. The other showed a steady rise throughout and the titre eventually reached just over 700 (the highest figure observed personally in human serum). Two months after the carrying period was over the Vi-titre was 20.

There was another patient who during convalescence showed a definite rise in Vi-titre from zero in steps up to 160, beginning two months after the onset of the disease and nearly three weeks after full convalescence had set in. But in spite of the very complete examination of over 60 specimens of urine and faeces by both direct and enrichment methods it was not possible to demonstrate a carrier condition.

The other temporary carriers failed to show any Vi-antibody in their sera at any time during which they were excreting *Bact. typhosum*, although it was present in low titre during the early part of the illness.

*In Chronic Carriers.*—During the routine examination of the stools and urine of healthy individuals for carrier conditions seven were found to be excreting *Bact. typhosum*. In six cases the organism was found to be present in considerable numbers in every stool passed, but in the seventh case typhoid bacilli were only found on one occasion. Blood-serum from the individuals in question was examined for Vi-antibody in dilutions from 1 : 5 upwards as recommended by Felix (1938), and the results are summarized below :—

Number of individuals	Vi-titre of serum
1	Nil
1	1-5
3	1-10
2	1-40

The above figures were all confirmed personally. The serum that failed to show the presence of any Vi-antibody was from the individual who only



showed *Bact. typhosum* in the stools on one occasion. Only three examinations were carried out as the man moved from the district and it was not possible to trace him. Other carriers were reported without Vi-antibody in their serum, but as low dilutions had not been employed in the test they have not been included in this series.

Considerable interest attaches itself to one of the cases. A female servant was found to be a faecal carrier in 1937. Record of her was lost until the early spring of 1939, when her stools regularly contained very large numbers of *Bact. typhosum*. The cultures always contained Vi-antigen but were "O"-sensitive and her blood-serum had a Vi-titre of 1:10. Arrangements were then made to attempt to cure the carrier condition which, as far as one could ascertain, had existed for many years. Cholecystectomy was finally carried out and the gall-bladder, on being opened, was found to be of the strawberry type and to contain cholesterin calculi. The operation was carried out in a women's hospital at some distance from the present writer, and unfortunately the gall-bladder and its contents were not available for examination. However, after discharge from hospital the stools, in glycerine and saline, were forwarded at regular intervals and examination of a considerable series has failed to demonstrate the presence of *Bact. typhosum*. Vi-antibody, however, remained, and three months after the apparent focus had been removed the titre was unchanged at 1:10. It was not possible to undertake further examinations.

#### Development of Vi-antibody in Inoculated Subjects during the Course of Diseases other than Typhoid Fever.

Although a large amount of data on this subject has been collected, much of it was produced before the standardized Vi-serum had been taken into general use by all laboratories and it has been decided, for the purpose of

TABLE IV.

Patient	Day of disease	Agglutinin Titres				
		TO	Vi	P. OX2	P. OX19	P. OXk
Pte. T. ..	6	640	20	0	0	50
	10	640	20	0	0	500
	15	320	5	0	0	1,000
	20	320	0	0	0	1,000
Pte. H. ..	4	160	80	0	0	25
	15	160	0	0	0	2,000
Miss I. ..	26	640	10	0	0	500
	11	320	0	0	0	2,500
Pte. B. ..	5	40	10	0	0	25
	11	80	10	0	0	2,500
	16	80	5	0	0	5,000
	20	160	0	0	0	2,500
Boy N. ..	2	20	10	0	0	50
	10	20	0	0	0	500
Serjt. W. ...	4	160	10	0	0	25
	11	80	0	0	0	1,000

this communication, to rely on personal experience only, where the examinations were carried out with two standard antigens in parallel with the local standardized serum and controlled by the "provisional standard Vi-serum" of Felix. The number of individuals examined, excluding all possible cases of "Enteric Group," was only fifty and comprised cases of tonsillitis, bronchial catarrh, tuberculosis, and tropical typhus fever. These conditions were chosen because in inoculated subjects such diseases appear to cause, on occasions, non-specific stimulation of the "TO"-agglutinins.

The series included ten cases of tropical typhus and six of these patients showed the presence of Vi-antibody, and the agglutinin titres are set out in Table IV, p. 28.

It will be noted that there is a general tendency for the Vi-antibody to disappear as the agglutinins for *Bact. proteus* OXk develop. Definite Vi-antibody was not seen in any other condition investigated except doubtful enteric group cases.

#### The Production of Vi-antibody in Laboratory Animals following the Injection of Live Bacteria.

The possibility of the very early development of Vi-antibody in natural infections, in view of the appreciable Vi-titres observed occasionally within the first and second days of onset of typhoid fever, suggested the following experiments:—

*Experiment 1.*—Five mice were given intraperitoneal injections of 20 million, a sub-lethal dose, of an eighteen-hour broth culture of *Bact. typhosum* Raw-Ben. The animals were killed at the intervals stated, blood removed by heart puncture, and the serum examined for Vi-antibodies.

Animal killed after 24 hours.	Vi-titre	..	..	Nil
" " " 48 "	" "	..	..	Nil
" " " 72 "	" "	..	..	5
" " " 96 "	" "	..	..	20
" " " 120 "	" "	..	..	160

*Bact. typhosum* was recovered from the spleen cultures in all cases. The above experiment was repeated upon fully grown white rats with double the dose of organisms. Daily "tail snippings" provided the serum which was pooled. Results of exactly the same order were obtained.

*Experiment 2.*—Six fully grown white rats were given 150 million of *Bact. typhosum* RV, grown in broth for eighteen hours, as intraperitoneal injections. The following day two of the animals were dead and the remaining four were extremely ill for the next thirty-six hours, after which they recovered quite quickly. Two of these rats were killed on the fifth day following the injection and their sera showed Vi-titres of 80 and 160 respectively and the other two had titres of 320 on the following day. As in the previous cases *Bact. typhosum* was recovered from the spleen cultures at the post-mortem examination.

It is appreciated that the above experiments did not reproduce the conditions of a natural infection in man, for both rats and mice appear to recover very quickly after most severe illnesses and their antibody production seems to be less delayed than is the case of some larger animals. Nevertheless the results are suggestive.

**The Production of Vi-antibody in Laboratory Animals following the Injection of Killed Vi-suspensions.**

The majority of small laboratory animals respond readily to intravenous or intraperitoneal injections of Vi-suspensions. The response, however, to killed bacteria depends upon the sterilizing agent, the dose of organisms, number of injections, etc. The individual response in animals of the same species may also vary considerably.

Whilst it has been appreciated for some time that the presence of phenol in suspensions of Vi-strains is not conducive to the production of Vi-antibody, there are large numbers of sterilizing agents that do not appear to interfere with the agglutinogenic properties of Vi-suspensions although the production of other antibodies may be affected. The value of silver and mercury salts as such sterilizing agents has recently been demonstrated by Rainsford (1938, 1939) and in this laboratory mercury salts have been employed for several years for preserving and sterilizing "O"-suspensions, and for the last two years weak solutions of mercuric iodide have been used for killing and preserving Vi-suspensions for the preparation of Vi-agglutinating serum. Generally a large single dose of bacteria will produce on the fifth or sixth day, following the intravenous injection in a rabbit, a serum with a negligible "H"-titre and a relatively high Vi and "O" titre. The difficulty with large doses for the inoculum is that they are very toxic and they have, in consequence, to be used with caution. According to Felix and Petrie (1938) formalized suspensions are unsatisfactory for the production of therapeutic sera, nevertheless the use of formalin as a detoxicating agent with large doses of concentrated suspensions for the preparation of Vi-agglutinating sera has given satisfactory results. The examples given below show the titres obtained during the preparation of such sera :—

*Rabbit 43.*

11.5.39 : "H" -, "O" -, and Vi-titres Nil. Given 750 millimetres formalized suspension T.R.V.

16.5.39 : "H" -titre nil. "O" -titre 1,000. Vi-titre 600.

*Rabbit 53.*

5.6.39 : "H" -, "O" -, and Vi-titres nil. 500 millimetres T.R.V.

10.6.39 : Vi-titre 240. Rest rabbit ten days.

20.6.39 : 2,000 millimetres T.R.V.

26.6.39 : "H" -titre 10,000. "O" -titre 20,000. Vi-titre 4,000.

**The Development of Vi-antibody following the Injection of Prophylactic  
T.A.B. Vaccine.**

In most countries of the world the bacterial components of the T.A.B. vaccine are killed by heat and the suspensions preserved by the addition of phenol or an allied preparation. Felix and Pitt (1934) first drew attention to the deleterious effect of phenol on Vi-antigen, and this was confirmed by other workers. More recently Felix (1938) has suggested that the phenol does not destroy the antigen, but that its presence inactivates the agglutinogenic function of the Vi-substance. Even freshly phenolized suspensions of typhoid bacilli may fail to elicit any Vi response when injected into laboratory animals. Nevertheless when animals have suffered very severe reactions after the injection of large doses of such vaccines occasional Vi-titres have been noted on the fourth or fifth day following the inoculation. This and the following record led to the further investigation of this point :—

A healthy male developed a very severe reaction after receiving 0·5 c.c. of ordinary T.A.B. vaccine. The reaction commenced five hours after the injection with a rigor, and the pyrexia that followed lasted for four days. Fearing an attack of enteric fever blood was taken on the fourth day. The blood-culture was sterile but the serum had an "O"-titre of 40 and a Vi-titre of 80. On the twelfth day the Vi-titre had fallen to zero.

Twenty-five further individuals with similar histories have since been examined on the third or fourth day after inoculation. Nine of these showed a titre for Vi-antibody between 5 and 40 and in one case the agglutinins on the fourth day were as follows :—

"H"	..	..	2,500
"O"	..	..	250
Vi	..	..	160

*Experiment 3.*—The twenty-four-hour growth of *Bact. typhosum* RV was washed off digest-agar slopes with 1 per cent phenol, well shaken, and then placed in the cold chamber, with occasional shakings, for seven days. The suspension was sterile after twenty-four hours, but further sterility tests were carried out on the fifth and sixth days. The strength of the suspension was then adjusted to contain 1,000 million organisms per c.c. in phenol-saline with a phenol concentration of 0·5 per cent. Ten fully grown white rats were given intraperitoneal injections of this suspension, each receiving 500 million organisms. The reactions were severe, but all the animals had recovered after forty-eight hours. The rats were divided into two batches and half were chloroformed on the fourth and half on the fifth day following the injection and bled out. The resulting sera were then examined for Vi- and "O"-antibodies. It is to be noted that the suspension injected was only faintly sensitive to a pure Vi-serum and failed to react with a pure "O"-serum. The following are the agglutinin titres of the sera examined :—

Rat number		Vi-titre	"O"-titre
4th Day .. ..	1	80	10
	2	40	160
	3	160	10
	4	80	20
	5	80	80
5th Day .. ..	6	80	160
	7	40	320
	8	40	640
	9	160	40
	10	20	1,280

*Experiment 4.*—A similar suspension of *Bact. typhosum* RV was prepared with 1 per cent formalin in place of the phenol. This suspension of 10,000 million was quite sterile in forty-eight hours' time. The formalin was diluted out with 1 : 10,000 mercuric iodide and the strength adjusted to 1,000 million per c.c. and 500 million given to seven rats as before. Pooled daily bleeds from tail-snippings were examined with the following results :—

		Vi-titre	"O"-titre
Before injection	..	Nil	Nil
1st day	.. ..	Nil	Nil
2nd "	.. ..	Nil	Nil
3rd "	.. ..	40	40
4th "	.. ..	640	320
5th "	.. ..	320	320
6th "	.. ..	160	640
7th "	.. ..	80	1,280

The strain RV is a Vi-culture which is deficient in "O"-antigen for, although the phenolized-suspension was only faintly sensitive to a pure Vi-serum, no "O"-agglutination could be obtained with either suspension. The formalin-mercury suspension was extremely sensitive to Vi-antibody.

The above two experiments do point to a very early production of Vi-antibody in rats and a fairly rapid fall in titre. In spite of the presence of phenol it would appear that special Vi-cultures can stimulate the production of Vi-antibody.

Experimental vaccines prepared after the manner described above have been given a limited trial in human subjects. The type of reaction observed with the standard T.A.B. vaccine was not recorded, but in place there was a definite heaviness of the arm and a general feeling of unfitness for three or four days. The trial was too small to be more than an indication, but the antigenic responses, "O" and Vi, were hardly superior to those noted with the ordinary phenolized vaccine. In view of the early fall that follows the rapid rise in Vi-titre in animals immunized with pure Vi-suspensions, and the successful mouse protection experiments with phenolized Vi-strains originally reported by Perry, Findlay and Bensted (1934), the advantage of the new form of vaccine does not seem proved. The agglutinin response of laboratory animals to the large doses employed for their immunization cannot be compared to the response of human subjects to ordinary vaccines.

## Discussion.

The presence of Vi-antigen in recently isolated cultures of *Bact. typhosum* is now too well recognized to require comment. In very few of such cultures does there appear to be a complete absence of this antigen, and in the majority it seems to be well developed, although there are not large numbers, when put to the severe test, that fail to show any reaction with a pure "O"-serum unless they are grown on special media. The slow growth on egg-medium in a reduced oxygen tension, as suggested by Gladstone (1937), would appear to enhance Vi production; as a result of cultivation by this technique numbers of "O"-sensitive strains have become completely "O"-resistant and once in this stage the strains, with ordinary care, are remarkably stable. Occasionally, however, a strain may revert for some unknown reason. Although it is a rare happening it is advisable to examine all stock cultures of Vi-strains from time to time from this point of view.

The fact that Vi-antigen can be encouraged to develop in the classical "T.901.O"-strain under the conditions described is not considered important, for there is no difficulty in retaining this strain in its original form as a pure "O"-culture.

The production of the Vi-forms deficient in "O"-antigen is of considerable practical value for, since it has been shown that such strains can be shaken with alcohol to remove the reacting part of the flagella, the production of pure Vi-antigens (for the estimation of Vi-antibody) is not limited to such strains as "T.Vi.1." Indeed there is some evidence, not yet sufficient to be definite, to suggest that these artificially produced pure Vi-suspensions are superior in their specificity.

Although these Vi-suspensions show no agglutination with pure "TH" or "TO" serum, yet they are capable of producing satisfactory "H" and "O" titres when injected into animals so that even in the dead bacteria there must be some efficient masking of these antigens. When the Vi-sensitivity has been much reduced by prolonged contact with alcohol or phenol such suspensions still fail to react with "O"-antibody.

The occasional failure to cultivate *Bact. typhosum* from the blood of patients in the early stages of the disease has not been stressed in this communication, for the importance of blood culture in the diagnosis of typhoid fever is not under discussion. Undoubtedly there are occasions when the technique or the media are at fault, but it is equally true that at other times the same technique and the same batch of media will give successful results four or five days—sometimes even two weeks—after a series of failures.

Whatever may be the true story of the initial pathology of typhoid fever it is generally thought that, before the bacteræmia that signifies the clinical establishment of the disease, there is multiplication of bacteria in other tissues. It is, therefore, possible that on occasions the reaction in those tissues or cells may be great enough to become a clinical entity and a local barrier immunity be developed to prevent a bacteræmia. The barrier would eventually break down and bacteria finally swarm into the blood-stream.



It is suggested that tissue reactions of this sort may be concerned in the early development of Vi-antibody; in the only case of this nature that has been fully investigated the blood-serum in the first few days of the disease had an appreciable Vi-titre but no "O"-agglutinins. Repeated blood cultures in the early stages were negative although the organism was recovered with ease later.

The estimation of Vi-antibody calls for considerable care, experience, and critical ability, but the technique itself is not complicated, although great attention must be paid to detail. Unless a serum is really clear and free from hæmoglobin no attempt should be made to carry out the test.

It is disappointing that the development of Vi-antibody cannot be demonstrated in every case of typhoid fever. The agglutinin curves of many of the cases under review were of less help than the estimation of "O"-antibody. The value of any such test depends upon its practical application in the diagnosis of disease. It is not suggested that Vi-antibody is not produced in every case of a typhoid infection, but it is maintained that its detection is frequently not a practical proposition for the routine clinical laboratory. The demonstration of Vi-antibody in the serum during the course of a continuous fever may be highly suggestive, but it is felt that considerable caution should be exercised before accepting the presence of this antibody as specific evidence of a typhoid infection or its absence as excluding such a condition.

It is of interest to note that Vi-antibody may develop during the early stages of tropical typhus fever, but it will be observed that there was no question of confusion concerning the diagnosis; in most cases the Vi-titres were falling before the OXk-titres had reached very high figures. It is not clear whether the production of Vi-agglutinins is stimulated in any other infective condition. Positive evidence on this point has not been observed by the present writer, but the series of cases is as yet too small to form any definite opinion.

For some time evidence has been accumulating that the chronic typhoid carrier regularly shows the presence of Vi-agglutinins in the blood serum (Felix, Krikorian and Reitler, 1935; Giovanardi, 1936, 1937; Pijper and Crocker, 1937; Felix, 1938; Bhatnagar, 1938). Out of the seven reported in this communication definite amounts of Vi-antibody were demonstrated in six of the carriers. It is possible that the seventh individual was an intermittent carrier, but although traces of Vi-antibody were found in dilutions of  $2\frac{1}{2}$  of the serum all higher dilutions from 1:5 upwards were negative. The fact that the "carrier" that has apparently been cured of her condition still retains her Vi-antibody is hardly surprising; there are other examples of immune bodies, developed during chronic infections, remaining long after a cure has been effected.

The higher Vi-titres found in animals following the injection of either live or dead bacteria, than those encountered in human subjects, is perhaps more marked than is the case with other antibodies. The very early response recorded in experimental infections would appear to have its parallel in some

natural infections in man where appreciable titres have been found immediately the disease has established itself, and it is reasonable to suppose that the antibody was developing during the incubation period.

It was suggested by Bhatnagar (1938) that inoculated subjects developed Vi-antibody more quickly during an infection than the uninoculated. The demonstration of transitory Vi-titres in certain individuals following ordinary phenolized T.A.B. vaccine, and the similar early response to large doses of phenolized suspensions of Vi-strains in rats and other immunity reactions in connexion with this antigen, suggest that in most cases the measurable response is shortlived but that residual antibodies in minimal amounts may persist to play their part in the reaction that follows an infection. The true explanation of the part that the Vi-antigen plays in infection and resistance, however, is still awaited.

#### Summary.

(1) An account is given of the Vi-content in recently isolated strains of *Bact. typhosum*, the maintenance of this antigen, and its development in cultures grown on egg-medium under reduced oxygen tension.

(2) The production of pure Vi-suspensions from strains other than "T.Vi.1" is described.

(3) A record of Vi-estimations in 80 cases of typhoid fever is given. At the very least, five cases failed to show any development during the whole of the illness from the third day onward.

(4) Vi-antibody was demonstrated in six out of seven chronic carriers and in two out of four convalescent carriers.

(5) The question of non-specific stimulation of Vi-antibodies is discussed.

(6) Certain experiments in relation to the animal response to the injection of live and dead bacteria are described, and the transient Vi-titres that were obtained are noted.

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## Editorial.

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### THE CONTROL OF TETANUS.

IN his paper on Tetanus in its statistical aspects, contributed to the Medical History of the War, Colonel S. Lyle Cummins states that the incidence of tetanus in pre-serum days varied within very wide limits in different campaigns. In the Peninsular campaigns, in spite of the excellence of the Medical Service under McGregor, tetanus carried off hundreds of our wounded. Rutherford Alcock in his statistics of the British Legion in Spain records an incidence of 12·5 per 1,000. Ballingall calculated the number of tetanus cases among wounded in armies was one in 79. Longmore quotes from Demme that tetanus occurred in 10 per cent of the wounded in Italian hospitals in 1859.

In the great wars coming later in the last century there was a decided diminution in the number of cases of tetanus. In the British forces in the Crimean War the records show only two cases per 1,000 wounded. In the American Civil War the incidence was two per 1,000, and in the Franco-German War, 1870–71, the records give 3·5 per 1,000.

In the South African Campaign, the Nile Expedition, and the Russo-Japanese War, tetanus seemed to have vanished completely. In the Franco-German War there were marked local variations. At Metz tetanus cases amounted to only 1·6 per 1,000, whilst in the northern theatre the incidence was 11 per 1,000. The factor of prime importance is the presence of the spores of the tetanus bacillus in the soil of the battle area and its introduction into the wound. When the environment is such as to favour the conservation of spores in the soil, tetanus will tend to be of common occurrence amongst the wounded in war.

In the war of 1914–18 the incidence of tetanus outside French and Belgian territory was insignificant.

Only seven cases occurred in Mesopotamia during the whole period of the operations. Six cases were reported in Gallipoli, all in patients with trench feet. Only four cases are known to have occurred in Salonika.

As in the Franco-German War of 1870–71, so in 1914–18 it was in the northern theatre of operations that tetanus became a serious problem, demanding a system of prophylaxis founded on modern conception of the disease. Cramer and Bullock alleged that calcium salts in the soil facilitated the establishment of tetanus germs introduced into wounds. This suggestion may help to explain the high incidence of tetanus in the northern part of France where a chalky soil is the rule.

Many records of the incidence of tetanus in 1914–18 have been published. Sir David Bruce was obliged to confine his figures to those available in

England, and his incidence rates were based on the number of wounded reaching home hospitals. Sir William Leishman's first records were also not complete; they did not include slow-developing cases which occurred after cases had been admitted to home hospitals. Later, on the introduction of case sheets, reliable information was obtained for the war areas. The total number of cases estimated in hospitals in France was 1,071. Adding these numbers to those given by Bruce it would appear that there were 2,529 cases of tetanus as the result of the fighting in France and Flanders. Official figures give the number of wounded, less gassed, on the Western Front as 1,710,369, so that the incidence of tetanus in those wounded on that front for the whole war amounts to 1·47 per 1,000. This figure shows little improvement on that for the American Civil War or the Crimean War, but Cummins points out that in no previous war have the combatants been exposed to wounding by projectiles of so terrible a character and in conditions so calculated to ensure earth contamination of wounds. He considers that the true measure of the success of prophylactic methods is to be found in a comparison of earlier months of the war on the Western Front with the subsequent periods of operations in the same area. In Chart I of his article he gives the ratio per 1,000 of cases of tetanus to total wounded. The figures are 8·5 in August, 8·8 in September, 7·6 in October, 3·0 in November, and 1·5 in December, 1914. The issue of serum on an adequate scale in October and November, 1914, was followed by a rapid fall in the incidence of tetanus, which reached a low level by December. From 1914 onwards the constant use of antitetanic serum eliminated any satisfactory control group for comparison. One source of reliable information was obtained from the effect of serum on cases of trench foot. For some time the majority of these cases were not protected, but in December, 1917, the Director-General of Medical Services in France ordered that serum should be given to all cases of trench foot, and a dramatic fall occurred in the incidence of tetanus in cases of this kind. The drop occurred in mid-winter at the very time trench foot was most prevalent. Another point of interest is that while there was a marked fluctuation of the tetanus rates in 1915, 1916, and the early months of 1917, the incidence became much more regular and on a lower level following on repeated prophylactic inoculations which were ordered in June, 1917, and coincided with the fall of tetanus incidence to 1 per 1,000.

In former wars the case mortality from tetanus was about 85 per cent. This figure is given by Gilbert Blane, Rutherford Alcock, and Longmore. In the American Civil War the mortality was 89·3 per cent, and in the Franco-German War, 1870-71, the mortality was 90 per cent. In 1914-18 there were 1,254 deaths in the total of 2,529 cases, amounting to nearly 50 per cent. This would be an over-statement as regards tetanus as many of the deaths were due to wounds. The figure also includes the whole period of the war and the case mortality was much greater during the earlier months than in any subsequent period.

The gradual reduction in case mortality was noted by the Adviser in Pathology on the Western Front and by Sir David Bruce. To get an idea of the real fall in mortality in all cases Colonel Cummins sorted the records of the Western Front into two-yearly periods. In 1914-15 the case mortality was 63·5 per cent; in 1916-17, 45·2 per cent; in 1918-19, 37·9 per cent. For the period 1916 to 1918 the case mortality was 43·2 per cent, showing that when the period of insufficient prophylaxis was excluded the death-rate from tetanus was only half that in previous wars.

The War Office Tetanus Committee classified cases of tetanus into four clinical types—I (a), (b), (c), II, III, IV. Bruce classified the cases in home hospitals and Cummins those in French hospitals in 1918. In order to deal with tetanus on the Western Front as a whole, Cummins combined these two analyses. Type I (c) trismus, the earliest symptom with incomplete closure of the jaws, was the commonest variety and the least fatal. Type I (a) with trismus coming on within twenty-four hours with complete closure of the jaws was the most fatal and the death-rate was comparable to that in earlier wars. No case of local tetanus (IV) proved fatal in home hospitals.

The interval between the date of injury and the onset of tetanus is important, and a long interval is all in favour of the patient. The surgeons in the American Civil War concluded that the later the appearance of tetanus after injury the better was the chance of recovery. Cummins gives a chart of the frequency curve of the incubation period up to the forty-fifth day after wounding. There is a rapid ascent in the curve to the seventh day, the highest peak is reached on the eleventh day, after which, with one peak on the fourteenth day, it gradually falls to a level at which the numbers cease to be significant. He concludes that the prophylactic inoculation was the factor leading to an increase in the incubation period.

With the exception of a few hundred doses purchased in Paris early in the War, all the serum used in the British Expeditionary Force came from England or America, and was standardized in terms of the United States units. On this system one unit of antitoxin neutralizes one thousand minimal lethal doses of toxin. It was usual to administer to each patient 500 units, and this was the dose recommended throughout the War by the War Office Tetanus Committee. In 1916 the Director-General, Medical Services, in France, issued a circular recommending 1,000 units for all injuries to vessels and to bone, and in all lacerated wounds. Every endeavour was made to give the first dose as soon as possible. As a rule it was given at the field ambulance and the amount given was recorded on the field medical card. In June, 1917, instructions were given that four prophylactic inoculations should be given at intervals of seven days. Cummins states that while giving full weight to efficient surgery in ameliorating and diminishing the mortality of tetanus, more especially when excision of wounds is practised as in the latter part of the War, the administration of antitoxic serum rather than surgery was the cause of the diminution of incidence, severity, and mortality and the prolongation of the incubation period.

In his article on the pathology and bacteriology of tetanus Sir F. Andrewes pointed out that Tulloch's work proved the existence of at least four distinct serological races, each agglutinated only with its own serum. The distribution of the types in the wounds of 100 cases of tetanus in English military hospitals was : 41 strains belonged to Type 1 ; 22 to Type 2 ; 33 to Type 3 ; and 4 to Type 4. Type 2 was most prevalent in Flanders, and Types 1 and 3 on the Somme, but all four types were found in cases receiving their injury in England. The seven strains employed in various serum institutes for the preparation of antitoxin were all found to belong to Type 1.

It is known that after a dose of antitoxin has been injected there is a considerable drop in the antitoxin content of the blood after a week has elapsed, and that after a fortnight it is difficult to demonstrate its presence. In an experiment MacConkey found that after the injection of 1,700 units the blood in three days contained  $\frac{1}{2}$  unit per c.c., after ten days the amount was less,  $\frac{1}{10}$  unit, but after fifteen days it was still more than  $\frac{1}{10}$  unit. The experience of the War, however, showed that long after such tests are of any avail enough antitoxin remained in the body to modify the action of the toxin though it could not prevent it, and some degree of protection remained after a hundred and forty-five days. Local tetanus occurred only in inoculated persons. The proportion of local tetanus rose from 1.1 per cent in 1914 to 23.4 per cent.

In 1936 the question of the provision of adequate supplies of tetanus antitoxin for the Army in the event of a European war was brought before the Army Pathological Advisory Committee by the Director of Pathology. Attention was directed to the fact that insufficient supplies of antitoxin existed at the outset of the last war and that it was several months before provision on a satisfactory scale was possible. He emphasized that it was necessary to make forward arrangements to prevent a repetition of this unsatisfactory position.

As a result of the deliberations of the Committee, contracts were placed with the Serum Institute for sufficient supplies of antitoxin for all medical units in the field in the event of the occurrence of a major war.

As a direct result of these preliminary arrangements the question of supplies of antitoxin for civilian needs in the event of air raids was taken up by a committee which had been brought into existence owing to the necessity of considering other questions of a bacteriological nature. Treasury sanction was obtained for the provision of a large quantity of antitoxin and the organization for the provision of a National Pool of antitoxin was undertaken by the Medical Research Council.

It was agreed that the Army would provide the antitoxin required on mobilization and the first week of war through its own arrangements. Subsequent supplies would be obtained from the National Pool. The antitoxin was dispensed in containers of ten doses provided with puncturable rubber caps and the prophylactic dosage decided upon was 3,000 inter-

national units, which is contained in approximately 3 c.c. of the serum. In addition supplies of antitoxin for therapeutic use were provided.

At the same meeting of the Army Pathological Advisory Committee in 1936, the Director of Pathology pointed out that the normal time taken to immunize a horse to the degree adequate to produce a satisfactory antitoxin was from four to six months. In the case of horses that had at some time or another received injections of alum tetanus toxoid and were subsequently employed to produce antitoxin the period was shortened to two or three months. He suggested the advisability of arranging that certain Army horses should receive two injections of toxoid at intervals of a month. They could carry on with their normal work during peace time, but in the event of mobilization could be handed over to the Serum Institute. This arrangement was made through the Army Veterinary Service, and for the last three years 30 Army horses pre-immunized in this manner have been available. During this period certain horses were lost for one or another reason, but further animals were inoculated to ensure that 30 remained available. At the outbreak of war fourteen horses were handed over to the Wellcome Serum Institute, Beckenham, and sixteen to the Lister Institute, Elstree. These thirty horses will provide a valuable addition for the accelerated production of antitoxin.

While prophylactic antitetanus serum accomplished much, it did not as used in the field, give absolute protection against tetanus, and there were the additional disadvantages of serum-sickness and serum-shock from repeated injections of foreign protein.

Recent years have seen the introduction of active immunization chiefly by the use of formol-toxoid. In 1924 Ramon discovered that toxin, if treated with a low concentration of formalin and kept at a temperature of 37° C. for about a month, lost its toxic action but retained its antigenic properties. This altered toxin was named "anatoxin" by Ramon, but on account of possible confusion with the word "antitoxin" it is more commonly known as "toxoid." Immunization with tetanus toxoid was first carried out on laboratory animals and horses. The inoculations gave rise to no ill-effects and produced satisfactory immunization which could be tested by estimating the concentration of antitoxin in the serum. The results of the first experiments on man were published by Ramon and Zoeller in 1927.

Ramon and his colleagues give three injections, the first of 1 c.c., the second, a month later, of 1.5 c.c., and the third, ten or fifteen days later, of 1.5 c.c., the last being designed to act as an *injection de rappel*. With this method they claim to obtain a titre of from 0.1 to 1 unit of antitoxin per c.c. of serum. The three-dose system of giving formol-toxoid has been followed by most workers on the Continent and in America and Canada.

It has been generally assumed that when the concentration of antitoxin in the serum of an animal reaches a certain level, it affords protection against infection with tetanus spores. Ramon and Zoeller state that in the horse 0.001 unit per c.c. of serum—that is sufficient to neutralize one minimum

lethal dose of toxin—will protect the animal from infection when a splinter of wood charged with spores is inserted into a muscle. They regard the horse and man as equally susceptible to tetanus.

In the Current Literature, November number of this Journal, 1937, we published an extract of some experiments by Sneath, Kerslake and Scruby bearing on this point. These workers established a standard technique for introducing measured doses of spores using calcium chloride as an irritant to secure their development. They immunized guinea-pigs in varying degrees, estimated the antitoxin of their serums, and then injected infective doses of spores. Forty-five animals had a titre exceeding 0.01 unit of antitoxin per c.c. of serum; these all survived. Seven had a titre ranging from 0.001 to 0.01: of these four died. The dose of spores injected was invariably fatal to unprotected animals. From these observations the authors conclude that an antitoxin content of 0.01 unit or over per c.c. of serum will confer protection against tetanus.

In his article written in May, 1938, Major Boyd points out that Sneath and his colleagues did not estimate the level of antitoxin after experiment in those animals which survived infection and especially in those which had a low antitoxin titre. This point has a close bearing on the problem of immunization. It is known that a further injection of toxoid in an immunized subject will lead to an immediate and vigorous production of antitoxin resulting from the stimulation of the sensitized reticulo-endothelial cells, or whatever the reacting mechanism may be.

If toxin has the same properties as toxoid, as seems probable, then the first few molecules of toxin produced from the germinated spores in an infected wound will set this mechanism in action and lead to an outpouring of antitoxin. If antitoxin is produced with the same rapidity as in toxoid stimulation it is probable that the antitoxin production will exceed and dominate the curve of toxin production, so that effective neutralization of the toxin will ensue. If the titre of antitoxin is high it is possible that the toxin produced by the spores will be immediately neutralized and fail to reach the reacting mechanism in a form capable of provoking antitoxin production. Observations with toxin-antitoxin mixtures revealed that over-neutralized toxin lost its antigenic properties.

Boyd writes that if these ideas are correct then the level of antitoxin in the serum is not the sole criterion of immunity: the property of producing antitoxin in response to stimulation with toxin plays an even more fundamental part. When the antitoxin titre is sufficiently high there is no doubt that direct neutralization of the toxin will occur without the intervention of the antitoxin-producing mechanism. But where the antitoxin titre is low and is backed up by a sensitive reacting mechanism, there is reason to believe that protection will be maintained by a rapid production of antitoxin in response to the first threat of tissue invasion by toxin.

The persistence of active immunity against tetanus has been tested by titrating the serum of immunized subjects at increasing intervals after



inoculation. Ramon and Zoeller found that men immunized by them had a titre of 0.1 to 1 unit per c.c. of serum shortly after inoculation. Thirteen of the men were examined four and five years later; one showed a titre of 0.004, eleven ranged between 0.01 and 0.1, and one reached 0.3 unit.

Sneath and Kerslake tested thirteen subjects one year and two years after immunization; there was some decline after one year, and little change in the figures obtained after two years.

Experiments on the use of tetanus alum precipitated toxoid were made in 1930 by Glenney. Birgey, Gold, Hall, and others have also tested the method. The results seemed to show that when the doses are given at long intervals a rather higher titre is obtained than that given by Ramon's three-dose method. After the injection of alum precipitated toxoid local reactions may occur, and there may be some local induration at the site of injection.

In the further treatment of immunized subjects who have been exposed to infection, Ramon and Zoeller recommend simultaneous injection with antitoxin and anatoxin. The antitoxin will give immediate protection and the anatoxin will rapidly increase the antitoxin production and active immunization will come into play before the passive immunity has faded.

Some observers criticize this proposal: they say the serum will over-neutralize the toxoid and destroy its antigenic properties.

Wolters and Dehmal have found in experiments with guinea-pigs that alum precipitated toxoid is absorbed very slowly, and when given at the same time as antitoxin will produce a satisfactory response.

Since 1928 more than 50,000 horses of the French Army have been immunized against tetanus. All have received at an interval of one month two initial doses of 10 c.c. of anatoxin, and 35,000 have received a third dose at varying intervals up to two years after the primary inoculation. No case of tetanus has occurred in the 35,000 horses which received three doses. Cases were very rare in horses which received only two doses, while they occurred with usual frequency in unprotected animals.

Ramon and Lemétayer have tested the serum of twenty-six horses inoculated several years previously, and twenty-two showed 0.03 unit per c.c. of serum. All with one exception had more than 0.001 unit, which the authors consider sufficient to protect horses against experimental infection.

At a meeting of the Army Pathological Advisory Committee the Director of Pathology raised the question of active immunization against tetanus as a routine measure in the British Army. As a result investigations were undertaken at the Royal Army Medical College in collaboration with Dr. R. A. O'Brien and his staff at the Wellcome Research Laboratories, where the various toxoids were prepared and the titrations of serums for antitoxin performed. The results of these investigations were so successful that active immunization against tetanus was introduced into the Army in 1938.

Boyd, O'Brien, *et al.*, found that tetanus toxoid antitoxin floccules

gave a negligible production of antitoxin ; on account of this poor response and the difficulty of preparing the floccules it was decided not to pursue this investigation further.

Tests with tetanus toxoid were then undertaken ; no reaction was produced in the volunteers and the results as regards the production of antitoxin were satisfactory.

Glenny and his co-workers have pointed out that in immunizing animals it is an advantage to allow a long interval to elapse between the first and second doses. This principle has been accepted, and in immunizing man with formol-toxoid an interval of four weeks has been generally adopted. It was decided to experiment at the College with a longer gap between doses in the hope that it might be possible to effect satisfactory immunization with two instead of three doses.

A number of volunteers were given a preliminary dose of 1 c.c. of toxoid and from twenty-one to twenty-six days later were given a second dose of 1 c.c. A month later the antitoxin titre varied from 0.005 to 0.02 unit of antitoxin per c.c. of serum. This was not regarded as adequate. Another group of men received the second dose from six to seven weeks after the first dose, and on testing them four weeks later the antitoxin titre varied from 0.01 to 0.1 unit per c.c. of serum. These results were above the average level believed to confer protection against tetanus infection and were equal to those given by the three-dose method as advocated by Ramon and his colleagues and widely practised in France.

Ramon and Zoeller found the first dose of toxoid produced little or no antitoxin in the serum but resulted in the development of a remarkable aptitude for antitoxin production when further doses of toxin were given. Their figures showed a gradual development of sensitization up to a month from the original dose. The two doses given by Boyd and O'Brien were practically at the same interval as Ramon's first and third dose, and the final results were so similar that it would appear that an intermediate dose given during the period when sensitization is developing, has little or no action in enhancing the final titre of antitoxin.

Following on the decision to employ active immunization against tetanus, the Director of Pathology arranged that an Army Council Instruction on inoculation against tetanus with tetanus toxoid should be issued in 1938. The Instruction stated that " the inoculation consists of two injections given at intervals of six weeks. It is not necessary to repeat the injections as the protection lasts for many years. While inoculations will be on a voluntary basis, officers commanding units will encourage officers and men to take advantage of this simple method of securing protection." A record of inoculations was to be kept in accordance with Regulations for the Medical Services of the Army, 1932. An Army form was also designed for reporting cases of tetanus.

A notice on the prevention of lockjaw was posted up in barrack rooms, canteens, etc., and officers were asked to bring the information to the notice

of all ranks. Some 70 per cent of the men of the Regular Army have availed themselves of this means of protection.

On the declaration of war and the expansion of the Army, the use of formol-toxoid was greatly extended and the Canadian and Australian contingents adopted it as a routine measure ; active immunization, however, still remains on a voluntary basis.

The policy of the British Army regarding the subsequent administration of tetanus antitoxin in the event of men, previously actively immunized, being wounded, differs from the French practice. The French advocate an immediate injection of toxoid for the freshly wounded and already immunized soldier. If the man has not been previously immunized he should receive first 1 c.c. of tetanus toxoid followed by 3,000 units of anti-tetanus serum, and then at fifteen days' interval two further injections of toxoid.

In the British Army the immediate administration of 3,000 units of anti-tetanus serum is required as an additional safeguard against infection ; this serum should be given at the earliest possible moment, but under the conditions of active service, when a casualty may remain many hours without receiving medical attention, the injection is often delayed. In these circumstances previous active immunization will be of great importance and may save many lives. Unfortunately it is not always possible to ascertain whether a recently wounded man has been immunized, though this information will be given in his documents when available, and the importance of immediate injection of antitetanus serum is obvious.

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## Clinical and other Notes.

### REMOVAL OF CASUALTIES FROM A LIGHT TANK (MARK VI).

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THE parts of the light tank referred to in these notes are annotated in fig. A as follows :—

- (a) Cupola (with hatch closed).
- (b) Gunner's hatch (closed).
- (c) Turret.
- (d) Foredeck.
- (e) Upper flap of vizor.
- (f) Lower flap of vizor.
- (g) Transverse ledge.



FIG. A.

Three methods are described :—

A.—Removal through the driver's seat, head first.

B.—Removal through the driver's seat, feet first.

C.—Removal through the cupola.

Of the three, A is, generally speaking, the easiest method ; B is specially for cases of injury to the lower limbs ; and C may be used in cases where the exit through the driver's seat is, for some reason, blocked.

The removal of the driver and the removal of the tank commander or gunner are dealt with separately.

#### (1) REMOVAL OF AN INJURED DRIVER (OTHER THAN LOWER-LIMB INJURY).

First the vizor (e, f) must be opened from inside by the gunner reaching forward over the driver's left shoulder ; meanwhile the tank commander

dismounts and, facing the injured man through the opened vizor, places both his legs to the left of the steering levers (unless the levers can easily be unscrewed at the base and removed).

The gunner then pushes the driver's shoulders forward, keeping his head well flexed to prevent it hitting the upper lid of the vizor. At the same time the tank commander grasps the driver by the hands and pulls him forward (fig. 1). So the driver rotates forwards on his knees and his head passes under the upper flap of the vizor, guided by the gunner from behind.



FIG. 1.



FIG. 2.



FIG. 3.



FIG. 4.

The second part of the manœuvre is to bring the injured driver across the tank commander's shoulders as for a fireman's lift.

To accomplish this, the commander retains hold of him with his right hand, disengages his left hand and, bending down to the right, passes it between the driver's legs and round his left thigh.

As he bends down to his right he also ducks under the driver's left arm which he is still holding and brings his left shoulder against the lower part of the driver's stomach, so that as the driver swings forward the weight is caught evenly across the commander's shoulders (fig. 2).

In this way the fireman's lift is effected (fig. 3), and with a little practice the manœuvre can be carried out in one smooth and continuous movement with the minimum discomfort to the injured man.

## (2) REMOVAL OF DRIVER WITH AN INJURED LOWER LIMB.

The object of this method is to bring the driver out through the driver's seat feet first, keeping his body and legs, as far as possible, in the same straight line, in order to avoid bending the injured limb at any point.

An additional man is required to steady the legs, while the tank commander is responsible for the hips and the gunner for the shoulders.

First an improvised sling, 3 or 4 feet long, is placed round the hip-bone of the injured driver by the gunner who is kneeling behind him in the body of the tank. He then lets the back rest down and lays the driver flat, supporting his shoulders from behind (fig. 4).



FIG. 5.



FIG. 6.



FIG. 7.



FIG. 8.

The commander stands astride the driver's vizor and grasps the ends of the sling; the extra man grasps the driver's ankles and gently straightens the legs by pulling in a longitudinal direction, if necessary bringing the feet up on to the edge of the lower flap of the vizor.

At a signal given by the tank commander the wounded man is lifted by all three simultaneously, until he lies horizontally with his feet just clear of the lower vizor flap (fig. 5).

He is then gradually moved forward out of the tank, at the same time being slowly rotated to the left, to bring his body at right angles to the tank so that he may be lowered comfortably on to the transverse ledge(s) which runs across the front of the driver's dashboard (fig. 6).

From this position the three men, standing the same side of the casualty (fig. 7), lift him and transfer him to a stretcher.

In some cases of broken thigh-bone it might be advisable to adjust a Thomas' splint while the driver is still lying in his seat. This would considerably lessen the risk of further damage in moving and make the actual lifting easier.

(3) REMOVAL OF INJURED TANK COMMANDER (OR GUNNER) THROUGH THE DRIVER'S SEAT.

An essential preliminary is to rotate the whole turret (*c*) slightly to the right, so that the passage between the floor of the turret and the driver's seat is as smooth as possible without angular protuberances.

The casualty is then drawn into the driver's seat feet first. The driver squats in his seat, facing the turret, and grasps the injured man's ankles, while the gunner supports the shoulders from behind.

Together they half lift and half slide him into the driver's seat.

From this point the procedure is the same as that described for removing an injured driver; either head first or feet first depending on whether his legs are injured.

(4) REMOVAL OF TANK COMMANDER (OR GUNNER) THROUGH CUPOLA.

The whole turret (*c*) must first be rotated through a right angle to the left to bring the cupola (*a*) to the front.

The driver then dismounts and climbs on to the superstructure, standing on the highest ledge astride the cupola and facing the back of the tank.

If the injured commander is lying on the floor of the tank, the gunner will first have to lift him on to his seat by the "human crutch" method.

Briefly, this is by wrapping the injured man's left arm round the lifter's neck, and grasping his waist with the right arm.

The gunner then steadies him on his seat and raises his arms up to the driver, who grasps them through the open hatch (fig. 8).

The injured man is now raised by a series of lifts, until he is brought to a sitting position on the front lip of the hatch with his back to the front and his legs inside the turret.

The driver holds him in this position (fig. 9) until the gunner dismounts and comes to stand on the right of the injured man.

The driver then gently lowers him backwards and the gunner lifts his knees out of the turret (fig. 10). He is then lowered on to the foredeck (*d*) in a sitting position with his back at the right-hand edge of the deck, where he is held by the driver. The gunner having dismounted, comes to stand at the side of the tank, back to back with the injured man (fig. 11).

The gunner now bends backwards and grasps him under his armpits and, bending forwards again, carries him off gently by the "back lift," while the driver lowers the legs of the injured man to prevent them dropping suddenly over the edge of the deck (fig. 12).

*N.B.*—It is unlikely that the driver would be wounded while the tank is in action, unless the whole tank suffered a direct hit head-on. It is possible, however, that he might suffer concussion by knocking his head, and be rendered unconscious.

In such a case he would have to be dragged backwards into the main part of the tank, the back rest having first been lowered. Furthermore, he should be curled up on the floor of the turret so as not to interfere with the rotation of the turret.

The gunner will, of course, have to take his place without opening the vizor if the tank is still under fire.



FIG. 9.



FIG. 10.



FIG. 11.

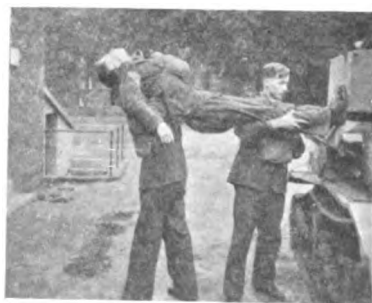


FIG. 12.

#### ACKNOWLEDGMENTS.

I am indebted to Lieutenant-Colonel W. H. Newson, M.C., T.D., commanding the Inns of Court Regiment, for permission to take the photographs and to forward these notes for publication.

I would like also to thank Captain T. G. Armstrong, R.A.M.C., attached to the Westminster Dragoons, for his assistance and advice during annual training at Warminster Camp; also Major H. J. Grainger and Lieutenant Sir James Ritchie of the I.C.R. for their valuable co-operation in arranging the necessary photographs.



## A CASE OF SEVERE VESICOVAGINAL FISTULA TREATED BY URETEROCOLIC IMPLANTATION.

BY CAPTAIN A. J. CLYNE,  
*Royal Army Medical Corps.*

SEVERE cases of vesicovaginal fistula are now, thanks to modern obstetric methods, a rarity in civilized countries.

In India, however, despite the excellent work and propaganda of civil and mission hospitals in the larger towns, there still remains a vast population yet in the dark ages of medicine. The unfortunate mother in obstructed labour will usually be treated by the village midwife. After an unsuccessful attempt at manual extraction such well-tried devices as packing the vagina with cow manure and rolling large and heavy stones over the abdomen may be tried. That any such patient ever survives to reach a hospital is a miracle. If more fortunate she will be taken to a practitioner with some Western training and delivered after much unskilled instrumentation. These are the cases that provide the examples of severe vesicovaginal fistula common throughout India.

The surgeon, faced with a severe and probably long-standing vesicovaginal fistula, must consider three possible courses :—

(1) Leave the patient in her misery, physical and mental.

(2) Attempt a closure of the fistula. The chances of success here depend on the size of the opening between bladder and vagina, its duration, and the amount of scar tissue present. The region is always grossly infected, and an unsuccessful attempt at closure leaves the patient worse off than ever.

(3) Attempt a ureterocolic implantation. As an alternative to an attempt at closure in doubtful cases this is in my mind the treatment of choice, as the operation is reasonably safe, not unduly difficult, and the immediate result in the case to be described was excellent.

### CASE REPORT.

The patient, a Hindu woman, aged 25, was first seen at the King Edward Memorial Hospital, Secunderabad, in January, 1939. She gave a history of difficult labour (her first pregnancy) about seven years ago, in which forceps had been used. The child died. Since then she has had continuous dribbling of urine with dyspareunia and dysmenorrhœa. Attempts at intercourse, which was now impossible, caused great pain. She had heard about the hospital in Secunderabad and decided to come in from her village to see if she could be cured.

*Examination.*—She was a well-nourished young woman otherwise sound. Pelvic examination revealed marked cicatricial stenosis of the vaginal outlet which admitted the tip of the index finger only. The little finger

could, however, be introduced up to the second joint, and a large opening between bladder and vagina detected, the tip of the finger just reaching the upper vaginovesical partition. The scar tissue formed a dense ring as hard as cartilage. There was continuous dribbling of urine from the orifice.

It was at once decided that she was inoperable from the point of view of any attempt at repair, and that a ureterocolic implantation offered her the only hope of future comfort.

*First Operation.*—Right ureterocolic anastomosis using a minor modification of Coffey's method was performed on February 2. The abdomen was opened by a mid-line subumbilical incision, the table tilted, and the intestines packed off. The right ureter was exposed as it crossed the pelvic brim, freed down to about  $\frac{3}{4}$  inch from the bladder, divided here and the distal end tied and the peritoneum then closed. This left about 3 inches of the ureter for implantation. The ureter was then implanted into the right posterior wall of the pelvic colon, just above the rectum, by Coffey's method, and the ureter buried for about  $1\frac{1}{2}$  inches in the bowel wall with Lembert sutures. The abdomen was closed and the patient put on free fluids and a urinary antiseptic.

Convalescence was apyrexial and uneventful, and the patient allowed up after fourteen days. There was no noticeable change in the amount of urine dribbling, but her motions were now mixed with urine.

*Second Operation.*—This was performed three weeks later and the left ureter similarly implanted into the left side of the colon posteriorly at a slightly higher level. The right anastomosis on inspection was completely satisfactory.

The patient was again put on free fluids and a urinary antiseptic, and again convalescence was apyrexial and uneventful. Dribbling of the urine *per vagina* of course ceased at once. Urine at first drained freely from the anus, but the rectum rapidly became tolerant to it and sphincter control returned, so that by the time of her discharge from hospital three weeks after the second operation, she could retain her urine about three to four hours. Her sphincter control became very good and she had no trouble in retaining it.

Pelvic examination prior to discharge showed that the vaginal outlet had become much softer and now admitted two fingers by which the bladder and vagina could be explored.

The patient returned to her village delighted with the result ; in fact the remarkable change in her general mental outlook after the second operation was one of the most gratifying features of the case.

#### DISCUSSION.

The immediate result in this case left nothing to be desired, but of the ultimate prognosis one must be more cautious. The textbooks say that the danger in such cases is that an ascending ureteric infection is likely to occur sooner or later, but as most examples would appear to be based on

the experience of the similar operation for ectopia vesicæ and the two are not quite comparable, it is difficult to make a prognosis. In this case the woman returned to her village and was told to report again in three months. This she is most unlikely to do if she is feeling well. Shortly afterwards I was transferred to another station, so I shall never hear of her again.

In conclusion I would say that in my opinion the excellent immediate result justified the operation, and I see no reason to be pessimistic about the remote results.

I wish to express my thanks to Lieutenant-Colonel R. F. D. MacGregor, M.C., I.M.S., late Residency Surgeon, Hyderabad, for his permission to send these notes for publication and for his kindness in giving me facilities to operate on this and other cases at the King Edward Memorial Hospital, Secunderabad.

## Echoes of the Past.

### TWENTY YEARS AFTER.

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(Continued from p. 380, No. 6, vol. lxxiii.)

#### II.—GUNSHOT WOUNDS OF THE CHEST.

CASE 10.—Hæmothorax from Wound of Subclavian Vein.

*Clinical History.*—Nature of wound : Gunshot wound, chest.

Signs and symptoms : Struck on chest. Wound leading to comminuted fracture of the right clavicle ; no exit wound. Temperature 97° F. on admission, later in the day 101° F., pulse 110. Next day signs of left hæmothorax. Temperature 103° F., pulse 110, respirations 56 to 66 ; is very distressed. Next day spitting up blood-stained sputum ; not offensive. Temperature 101° F., pulse 110, respirations 40. Thought to have a small hæmothorax and apical pneumonia. Next day temperature 100° F., pulse 106, respirations 42. Apex beat one and a half inches outside nipple line. Next day very dyspnoëic ; temperature sub-normal. Died.

Operation : Wound excised under local anæsthetic.

Survival : About ninety-six hours.

*Post-mortem Result.*—Chest : Comminuted fracture of the right clavicle with a wound of the right subclavian vein. The right pleura absolutely full of blood, thin, not clotted. Upper lobe of the right lung was solid, very dark red in colour (? red hepatization or concussion hæmorrhage) ; the rest of the lung collapsed. Left lung a little congested.

Pathological report : Section of portion of the upper lobe of the right lung shows extensive hæmorrhage in the lung tissue, the cause of which is

not apparent. No evidence of pneumonia. (No. 5 Canadian Mobile Laboratory.)

CASE 12.—Hæmothorax and Laceration of Spleen. Wound of Heart.

*Clinical History.*—Nature of wound : Gunshot wound, chest and abdomen.

Signs and symptoms : Admitted 3 a.m. ; died immediately on admission.

*Post-mortem Result.*—Chest : Wound in the left chest is in the anterior axillary line, through the 6th rib into the pericardium and apex of the left ventricle ; in the pericardium there was about two and a half ounces of blood. The left pleura was full of blood and the lung was collapsed ; the margins of the lower lobe were filled with blood for about two inches ; could see no actual wound ; attribute it to concussion hæmorrhage. (We see it in every case of chest injury.) The diaphragm is depressed. The right side of the chest was normal.

Abdomen : There is a wound in the left flank. The spleen is much lacerated ; much blood-clot tracking down the wall of the descending colon, which was not perforated. There was a handful of blood-clot around the spleen, and about a teacup full of blood free in the peritoneal cavity. Presumably during the collapse the hæmorrhage stopped somewhat. Did not trace the wound in the flank, but it was the exit wound of the chest missile ; there was a track of blood-clot down from the wound in the diaphragm to the left of the liver and stomach into the left flank.

CASE 13.—Wound of the Lung and Liver. Shock.

*Clinical History.*—Nature of wound : Shell wound of chest and abdomen. Other multiple wounds.

Signs and symptoms : Extremities cold, pulse feeble, respirations rapid.

Operation : Operated on shortly after admission owing to multiple wounds which were excised (including one of the pericranium). The wound of the chest wall was excised and drainage tube inserted. Very shocked that night ; never recovered properly.

Survival : About twenty-four hours.

*Post-mortem Result.*—Chest : A penetrating wound of the right pleural cavity in the posterior axillary line, through the 8th interspace and upper edge of the 9th rib, grazing the base of the lung and going through the diaphragm into the convex surface of the right lobe of the liver, penetrating a little distance. (Foreign body not found.) The liver substance had bulged into the wound of the diaphragm, shutting off the peritoneal cavity ; around the point of entrance there were many small lacerations and hæmorrhages. A little blood in the right pleural cavity ; right lung slightly collapsed ; around the site of the pleural abrasion on the base was a wedge-shaped area of hæmorrhage into the base of the lung. Both lungs œdematous ; the left slightly emphysematous. Some serous fluid in the left pleural cavity. A little dark blood free in the peritoneal cavity. Liver somewhat blanched. Spleen small and normal looking.

## CASE 16.—Hæmothorax with Gas Infection. Wound of Liver.

*Clinical History.*—Nature of wound : Gunshot wound, chest.

Signs and symptoms : Wound lateral to the right nipple line ; oozing freely. Temperature on admission 98° F., respiration 36. Next day felt easier. Temperature 102° F., pulse 120, respiration 36. Abdomen appears to be normal, though he complains of pain over the epigastric region. Several days later he appeared to be improving. Examination of the chest showed impairment of resonance in the lower part of the right side ; breath sounds slightly diminished in this area. Heart : Apex beat about normal in position. Temperature 100° F., pulse 140, respiration 42. About eight ounces of dark foul-smelling blood taken from the right chest. Died next morning with a temperature of 98° F. and pulse 120.

Survival : Four days.

*Post-mortem Result.*—Chest : The wound through the chest wall was in the fourth right interspace in the anterior axillary line, chipping off the upper border of the 5th rib. The pleural cavity contained some foul gas, and was half full of dark liquid blood with an offensive odour. The lung was covered with a thick membrane which could be pulled off. (? fibrin from the blood or exudate.) This was also present on the diaphragmatic pleura. On the diaphragm was found a small piece of bone, and near this, a hole about the size of sixpence in the diaphragm ; this led into a wound of the upper surface of the right lobe of the liver ; this was continued as a track two inches long under the surface, coming out again. There was no sign of a foreign body, and no sign of hæmorrhage in the peritoneal cavity. (Presumably as usual the diaphragm contracted on the wound in the liver.) The lung was much collapsed and airless.

Comment : The temperature was again unreliable as a guide to the condition ; the pulse and respirations were more valuable. Thirty-six hours before death it struck me he was not doing too well ; his breathing was very rapid. The gas in the pleural cavity made the resonance more marked than it would otherwise have been, and was misleading as to the amount of hæmothorax.

Pathological report : Blood from chest. Aerobic culture : Staphylococcus. Anaerobic culture : Gram-positive capsulatus gas-forming bacillus, probably *Bacillus aerogenes capsulatus*.

## CASE 30.—Hæmothorax and Secondary Hæmorrhage.

*Clinical History.*—Nature of wound : Gunshot wound, chest.

Signs and symptoms : Hit near the left axilla with shrapnel ; in the course of the first two days he got very pale. Temperature rose to 102° F., pulse 120 ; after that temperature dropped to normal, but the pulse remained about 120 ; colour very pale. He was aspirated, and forty ounces of dark offensive blood was withdrawn ; several ounces of Eusol were introduced ; after this he was more comfortable. Twenty-four hours later he was operated upon ; did well for that day, but died next morning from hæmorrhage.

Survival : About three and a half days.

Operation : Under local and light general anæsthesia the 7th rib was resected, foul smelling blood evacuated and Eusol washed through from the tube in the wound of entrance in the axillary region out through the lower tube.

*Post-mortem Result.*—Chest : A coating of fibrin over the parietal and visceral pleura ; lung collapsed to half its size ; in the lower lobe a large piece of shrapnel lay loosely embedded in the lung ; evidently from here the hæmorrhage had proceeded (! either from pressure erosion, or from septic ulceration of a vessel). Blood-clot in the pleural cavity.

Comment ; He had always been too ill to be removed for X-ray. (Rarely is it of much importance to locate the foreign body in chest cases ; here possibly removal might have saved his life.)

CASE 33.—Hæmopneumothorax and Lobar Pneumonia. Gas Infection of Wound.

*Clinical History.*—Nature of wound : Gunshot wound, chest. (Shrapnel.)

Signs and symptoms : Hit with shrapnel just below left axilla ; no wound of exit ; also gassed. On admission temperature 97° F., pulse 126. Dyspnœic. Colour, pale ; somewhat collapsed. Left side of the chest resonant, but was not examined much. Given oxygen for fifteen minutes every hour through a nose-piece with relief. Next day temperature 103° F., pulse 122. Colour much improved though is still very dyspnœic. Next day temperature 101° F., pulse 146. Heart displaced to the right of the sternum ; left side of chest resonant ; breath-sounds not heard. Over the right upper lobe breath-sounds puerile (probably pneumonic, Colonel Rigby thought). He also had gas infection of his wound ; coppery discoloration of the skin and emphysema spreading down the chest wall.

Slightly improved in the afternoon after the operation but still very ill ; dyspnœic and restless. Next morning temperature 98° F., pulse 132, colour bluish. Is very restless. Died the same evening. Unconscious for the last seven or eight hours ; colour livid. Tube was draining well ; discharge from it not offensive. Gas gangrene of the chest wall not extending, in fact was improving.

Operation : Under light open ether the chest wound was excised. The wound through the fractured rib was enlarged and almost two pints of dark blood (frothy and inodorous) were evacuated. A tube stitched in. Gas gangrene area of the chest wall freely incised, and a Eusol dressing applied.

Survival : About fifty-six hours.

*Post-mortem Result.*—Chest : Wound of the chest wall leading through the left 7th rib at the posterior axillary line ; a little blood in the pleural cavity. The lung was partly collapsed ; anterior surface covered with adherent lymph. Lower lobe pneumonic, most intense nearest the site of the perforating wound which went through the outer border of the lower lobe and came out at the base. The right lung extremely congested, otherwise normal.

Heart : Perhaps slightly to the right, but not much ; no evident lesion. Some ante-mortem clots in both ventricles, aorta, and pulmonary artery. No wound of the diaphragm seen. No foreign body found in the pleural cavity. Abdomen normal.

CASE 38.—Wound of Liver and Haemopneumothorax.

*Clinical History.*—Nature of wound : Gunshot wound, chest and arm. (Shrapnel.)

Signs and symptoms : Hit with shrapnel on the left costal margin, just to the left of the mid-line ; wound of exit is about two inches to the right of the right nipple ; there is also a lacerated wound through the right upper arm in the track of the same missile. He coughed up about two ounces of blood before admission. He is extremely pale and collapsed. Temperature subnormal. Chest : There is a churning noise in the right chest occasionally, as of air and blood mixed ; much oozing from the right chest wound. No definite surgical emphysema felt. Abdomen rigid. Decided to give him morphia, and rest in a semi-recumbent position. Next morning he felt better ; abdomen less rigid. He was thought to be a case of hæmopneumothorax, with a possible wound of the liver. Later on that day his abdomen became somewhat distended, especially in the suprapubic region ; flanks resonant ; liver dullness mostly gone. Temperature 96° F., pulse 148. Is unconscious and dying.

Survival : About thirty-six hours.

*Post-mortem Result.*—Neck, chest and abdomen : There is some surgical emphysema in the right side of the neck. The wound in the abdominal wall is at the tip of the 8th costal cartilage, about one and a half inches from the mid-line ; it leads along the anterior surface of the liver at its junction with the superior surface ; in situ it looked comparatively superficial, and the liver herniated through a hole in the diaphragm (size of half a crown) into the right pleural cavity ; when the liver was removed the wound was seen to be both extensive and deep. The wound of exit was through the 6th intercostal space in the anterior axillary line (about one and a half inches below the nipple line and two and a half inches external). The lung was partly collapsed, containing blood in its lower lobe, especially near the base, but it showed no trace of wound. The pleural cavity contained quite twelve to fifteen ounces of blood ; the dark semi-solid condition of the lung was either the result of the compression exerted by the hæmopneumothorax, or, as it was definitely hæmorrhagic in its lower part, perhaps due to concussion hæmorrhage. There was some surgical emphysema in the mediastinum. The abdomen contained about half a pint of blood in the flanks and in Douglas' pouch. There was no free gas in the peritoneal cavity. The loss of liver dullness was due to the colon being pushed up under the liver. The stomach contained a quantity of dark fluid (probably not blood, as there was no wound). The pericardium was normal.

Arms : The brachial artery and median nerve were uninjured.

CASE 46. — Hæmothorax and Hæmoperitoneum with Gas Infection.  
Laceration of Lung.

*Clinical History.*—Nature of wound : Gunshot wound, chest.

Signs and symptoms : Hit in the back just to the left of mid-line about the 6th or 7th rib, fracturing it and penetrating the thorax. Dyspnœa on admission ; relieved in semi-recumbent position. Next day pale and very dyspnœic. Breath sounds audible over the front and lower part of the left chest, though not so loud as on the right side ; too bad to examine the back of the chest. An exploring needle was put in on both sides ; negative result. Died later in the day.

Survival : About thirty hours.

*Post-mortem Result.*—Chest : Left lung partly adherent, but pleural cavity absolutely full of dark blood, which was clotted in places. All except the apex of the left lung was disorganized ; the lung was much lacerated and practically absent in parts ; in what was left of it (with the exception of the apex) there was nothing but dark blood. There was a hole in the diaphragm just to the left of the left lobe of the liver, and in front of the spleen. The other lung was normal ; no sign of collapse.

Abdomen : Free dark blood in the peritoneal cavity, but could find no visceral lesion.

Bacteriological report : Films made from the hæmothorax were heavily infected with the *Bacillus aerogenes capsulatus*.

Comments : The state of the lung was worse than in two previous autopsies of gunshot wound of the chest, where the lung was totally adherent and there was no blood in the pleural cavity. The patient also lived longer, though not so long as those cases of hæmothorax pure and simple (without much hæmorrhage into the lung), which die of infection. Presumably the aspirating needle struck the blood clot, hence the negative result.

CASE 57.—Laceration and Hæmorrhage into Lung.

*Clinical History.*—Nature of wound : Gunshot wound, chest.

Signs and symptoms : Wounds on both sides of chest as the result of a raid. Cold, pulseless and pale.

Survival : About an hour.

*Post-mortem Result.*—Chest : The left chest was entered behind the posterior axillary line, furrowing the posterior wall of the chest on the inner side of the ribs and wounding the lower lobe of the left lung ; the lacerated lung contained several small pieces of bone, but no shrapnel. The whole lung was densely adherent all over (old) ; the lower lobe was solid with hæmorrhage ; the upper lobe a little congested. Right lung normal. Heart : Right auricle and ventricle much dilated.

Abdomen : Normal.

Comments : What the cause of death ? Was it due to the adherent pleura, in consequence of which he bled into the lung instead of into the pleural cavity ?



## CASE 60.—Hæmopneumothorax.

*Clinical History.*—Nature of wound : Gunshot wound, chest.

Signs and symptoms : Hit in the upper part of the left chest ; a through-and-through wound coming out through the scapula. Developed a hæmopneumothorax. Was aspirated a day or two after admission, some blood and air drawn off ; this gave relief. Bacteriological report was negative. A day or two later aspirated again : this rather knocked him out ; air came straight through from the lung. Temperature became pretty high subsequent to this, and remained up until death. Aspirated again a day or two later ; died shortly after.

Survival : About five or six days.

*Post-mortem Result.*—Chest : Marked bronchitis on both sides. There was a track through the upper lobe of the left lung, surrounded by blood-clot, which in one part had become converted into an abscess. The wound in the lung still communicated with the pleura, and there was a good deal of hæmothorax. Some bronchopneumonia in the lung surrounding the wound track.

Bacteriological examination : (1) Mucopus from the bronchi contained small bacilli like influenza bacilli, also streptococci ; (2) pus from the lung abscess contained streptococci ; (3) film from the hæmothorax contained streptococci.

Comments : Possibly the suction of aspiration kept open the wound of the lung, and caused infection of the hæmothorax from the bronchi.

## CASE 61.—Hæmothorax and Hæmorrhage into Lung.

*Clinical History.*—Nature of wound : Gunshot wound, chest.

Signs and symptoms : A through-and-through wound entering the upper part of the right chest anteriorly, and coming out through the scapula behind.

Survival : About forty-eight hours.

*Post-mortem Result.*—Chest : The right lung was adherent in places, but he had a good-sized hæmothorax ; also some hæmorrhage into a moderate area of lung substance.

Bacteriological examination : Film from the hæmothorax showed a Gram-positive coccus, chiefly in pairs.

## CASE 62.—Bilateral Hæmothorax and Infective Pericarditis.

*Clinical History.*—Nature of wound : Gunshot wound, chest. (Shrapnel bullet.)

Signs and symptoms : Hit in the left shoulder, penetrating the 3rd intercostal space. Left pleural cavity aspirated, a tube put in through an intercostal space, and washed out with Eusol every six hours.

Survival : Several days.

*Post-mortem Result :* Chest : The track of the bullet was through the 3rd interspace, through the left lung, and then through the upper and posterior part of the pericardium, then across the upper surface of the right

dome of the diaphragm, contusing it. There were recent fibrinous adhesions of the left lung, shutting off clear brownish fluid in other parts of the pleura from the drainage tube. The left lung was somewhat collapsed, but otherwise healthy. There is some turbid fluid in the pericardial sac; some fibrin over the heart which was much dilated. In the right pleura there was a good-sized hæmothorax; the shrapnel bullet was lying at the bottom of the cavity.

Abdomen: Some blood on the under surface of the right side of the diaphragm; also extending from there into the pelvis. (This blood and the hæmothorax are apparently due to the contusion; could see no actual open wound.)

Bacteriological examination: Films from the left pleura during life showed an organism like *Bacillus aerogenes capsulatus*; culture showed streptococci. Films from the right pleura taken at the autopsy showed Gram-positive cocci, mostly in pairs; also some short chains. Pericardial fluid taken at the autopsy contained Gram-positive cocci, mostly in pairs; also short chains. Film from the left pleura taken at autopsy showed no organism: the previous positive finding from the left pleura was during life. It looks as if the Eusol had been quite effective.

#### COMMENTS MADE IN 1937 AFTER REVIEWING THE NOTES.

*Hæmothorax*.—In practically every case this was due to injury to the lung (or chest wall), but in one case, No. 10, it was due to a wound of the right subclavian vein. Case 10 illustrates that an exploring needle (in spite of its occasional failures) would have revealed the most disabling factor in this case, viz., hæmorrhage; although, of course, it would not have revealed its origin. A bacteriological examination would have revealed that, in spite of the fact that the temperature was 103° F., there was no infection.

I do not think even good portable X-rays will ever replace a decent-sized aspirating needle.

Recognition of the fact that No. 10 was bleeding from the subclavian vein would have saved him.

The signs and symptoms of hæmorrhage to this day are not always clearly recognizable. A high leucocyte count is not usually expected, yet I have seen a big abdominal hæmorrhage with a count of 30,000.

As to the treatment of hæmothorax (when uninfected) varied opinions were expressed at the meeting of the Second Army Medical Society in Ballieul in 1916. I expressed myself in favour of aspiration at the C.C.S. or shortly after arrival at the Base, so as to avoid long-standing compression of the lung. This view was also taken by most of those who had seen the cases at Base Hospitals in England, particularly those with post-mortem experience.

*Infection of Hæmothorax*.—This was a frequent cause of death; the infecting organism was usually *B. aerogenes capsulatus*, as in Cases 62, 46, 33, 30, and 16; occasionally a mixed infection. Those cases which escaped

infection, or where it was of a milder nature, were evacuated to the Base. The cases with gas infection were usually quickly fatal. (As it is more often a toxæmia rather than a septicæmia, it is possible that it would be amenable to frequent irrigation with Eusol, Dakin's, etc.) Sometimes the infection came from the man's own lung, e.g. where he was the victim of bronchitis (not an uncommon affection in that severe winter of 1916-17). In Case 60, where the lung of a man with bronchitis had been wounded, there was bronchopneumonia around the wound track and abscess formation at one part; the infecting organisms in the case were bacilli like influenza bacilli, and streptococci. Several cases have been recorded lately of streptococcal empyema treated by injection of 5 cubic centimetres of Prontosil into the pleural cavity. In these cases the improvement was immediate and the recovery complete.

*Hæmopneumothorax.*—This was met with occasionally; the air came either from the wounded lung or from without. It was later recognized that in gunshot wound of the chest it was essential as soon as possible to put a copious dressing over the wound to prevent this pneumothorax, which in the case of large wounds may cause collapse of the affected lung and a "flapping mediastinum"—fatal in its effect. Subsequent to the War, Graham worked out, on mathematical principles, that the largest opening compatible with life in a healthy adult is about two by four inches.

In hæmopneumothorax or in gas-infected hæmothorax, the resulting resonance is sometimes misleading; it conceals the extent of the hæmothorax. Case 16 is illustrative of this point.

*Gas Infection.*—The importance of either immunization against gas infection, or efficient treatment of it by serum, is emphasized in this series of cases where—apart from the appalling mortality of gas infection itself—cases of multiple flesh wounds were subjected to excision for fear of gas infection; in some of these, the presence of a chest complication such as an uninfected hæmothorax (which would otherwise have recovered) was sufficient to turn the scale against the patient.

*Aspiration.*—This (which is one of the most useful adjuncts of chest surgery) in Case 46 was misleading, due to the fact that it struck blood-clot; it withdrew nothing.

*Surgical Emphysema.*—This was not common. Case 38 was unusual. It showed emphysema on the right side of the neck at the autopsy, also in the mediastinum; presumably this had been entered by the missile. The air came either from the wound of exit in the chest wall, or from the lung (in which, however, no wound could be found).

*Injury to Rib.*—In some cases portions of the rib were driven into the lung.

*Temperature and Pulse.*—In chest cases, as in every other part of the body, the pulse was a much better guide than the temperature.

*Thoraco-abdominal Injuries.*—These were not uncommon; in most cases the missile went from the chest into the abdomen (from above downwards).

*Hæmorrhage into the Lung.*—Over and over again we find this associated in some cases with a wound of the lung, in others merely due to concussion from the adjacent passage of the missile. Case 62 is a case in which there was a contusion of the upper surface of the diaphragm from the grazing of a shrapnel bullet (found at the bottom of the pleural cavity). Yet there was some blood in the peritoneal cavity ; some of it had gravitated down into the pelvis. Where the lung was adherent to the parietal pleura and the blood could not escape into the pleural cavity death seemed to come on more quickly. Case 57 seems a case in point. In Case 46, in which the lung was partly adherent, it was so disorganized that only the apex could be recognized as lung tissue.

*Heart Wounds.*—These were uncommon ; most would die on the field. We had one case, No. 12, which had a wound on the left ventricle, together with hæmothorax and lacerated spleen ; he died shortly after admission. There was one case in which the pericardium was in the track of the missile ; this was not suspected during life ; it showed streptococcal infection similar to the pleura. Whether it would have responded as well to the Eusol irrigation as the adjoining pleura did, is, of course, a matter for conjecture ; or whether Prontosil (or allied drugs) injections in cases of streptococcal pericarditis of the future will help, I cannot say.

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## Current Literature.

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WATER WORKS AND SEWERAGE. 1938, v. 85, 1130. **Galvanic Corrosion Stopped by Water Treatment.** [Summary taken from *Pub. Health Engineering Abstr.* Washington. 1939, May 13, v. 19. Signed R. E. Tarbett.]

“ Experimental work under way by the Division of Sanitary Engineering of the Department of Public Health of Massachusetts is revealing that, in spite of corrective treatment of the water, galvanic action continues to occur in piping systems wherein dissimilar metals are brought together. Combinations of nine different kinds of service pipes (including those in common use to-day) have been immersed in raw surface and ground waters and in surface and ground waters treated to prevent corrosion. Results to date indicate that treatment with soda ash or lime has little or no effect on corrosion caused by galvanic action. Therefore, it is apparent that treatment of the water at the source is only effective in preventing corrosion at joints when a uniform kind of pipe is used in the distribution system and services. The conclusion is that anti-corrosion treatment does not prevent corrosion of services where pipes of dissimilar metals are used in contact with each other.”

*Reprinted from “ Bulletin of Hygiene,” Vol. 14, No. 9.*

## Current Literature

**The Use of Heavy Naphtha in Bed-Bug Disinfestation.**  
*Inst.* 1939, v. 59, 671-80.

The article deals with the use of washed heavy naphtha by the Liverpool Health Department for bed-bug eradication in unoccupied, empty dwellings. Since 1934 and 645 tenements had been treated with, it is claimed, no cases of failure at the first application of naphtha. A description of the procedure for fumigation is given. First, the room is sealed and then, if outside temperature is below 65° F., it is heated by stoves burning paraffin. The concentration of vapour after eighteen hours' exposure is 0.15 per cent, and for this 12 hours' exposure is necessary. For practical purposes, however, 60° F. is sufficient. The minimum temperature during fumigation. To minimize damage, screens are removed and their numbers checked and the gas is removed. Then screens of cotton cloth on to which naphtha is sprayed are hung 4 in. from the walls on wooden frames. Old newspapers are placed across the roof-space floor and sprayed with naphtha. The loft door is sealed. Spraying is then continued, from top to bottom, keeping the door of the room closed. In badly infested rooms and in corners in passages the use of screens is inconvenient the liquid is squirted with a sprayer. One gallon of naphtha per 750 cubic feet of space is necessary. The heaters leave by the door of the last room to be treated. The sprayer described in a previous review (*Bulletin of Hygiene*, 1938) has not been used in Liverpool. After twenty four hours the house is opened and ventilated, the vapour disperses with great rapidity. There is no tendency for the vapour to "build up" on closing the house after ventilation. The writer of the article states that heavy naphtha vapour is not dangerous to human beings, for there have been neither obvious ill-effects from the fourteen men employed in the work during fumigation. Damage to paint work and redecoration costs are small. The use of cotton screens. The importance of a well-trained team who must take meticulous care with every detail of fumigation. The concentrations of vapour are to be maintained, is stated. A team of three men can fumigate one house a day. For such teams, fumigate approximately twenty houses. The average cost of £5 12s. 4d. per house. The vapour is checked four times before the end of the first fumigation, and then by the decorators. The author's words (rather sanguine) "the experience of bugs comes to light before the end of the first fumigation" it is certain that the treatment has been successful.

For a list of the necessary materials for naphtha  
fumigation, see C. JOHNSON,  
"The Use of Naphtha in Hygiene," Vol. 14, No. 9.

## Reviews.

---

**ASTHMA.** Second Edition. By Frank Coke, F.R.C.S., with the collaboration of Harry Coke, M.R.C.S., L.R.C.P. Bristol: John Wright and Sons Ltd. 1939. 20 illustrations. Pp. xii + 258. Price 15s.

The second edition of this book, published sixteen years after the first, has been completely revised in the light of the author's experience gained in this period, and of much important work into the factors involved in the causation of asthma and their mode of action. Following a preliminary description of allergy, anaphylaxis, and sensitization, the author gives in full detail the ætiological factors involved, and proceeds to describe the investigation of a case from the standpoints of heredity, history, sensitivity, bacteriology, and blood cytology and biochemistry. He distinguishes three main types of asthma—allergic, microbic, and a mixed type which includes the aspirin-sensitive group. The erythrocyte sedimentation rate and the differential sedimentation test, which is fully described, are used in the differentiation of the three types, and in prognosis and control of treatment. Finally, the treatment of the three types is discussed.

The book is attractively written and presents concisely, and with ample references to the literature, an interesting and instructive and comprehensive treatise on the present knowledge on the subject. T. M.

**TEXTBOOK OF MEDICINE.** By Various Authors. Edited by J. J. Conybeare, M.C., D.M.Oxon., F.R.C.P. Fourth Edition. Edinburgh: E. and S. Livingstone. 1939. Pp. xvii + 1112. Price 21s. net.

- The fact that four editions and two reprints of "Conybeare" have appeared within the short space of ten years is sufficient evidence of its continued popularity.

The whole work has been brought thoroughly up to date, and a section dealing with psychological medicine, contributed by Dr. Desmond Curran and Dr. Eric Guttmann, introduced for the first time into this edition, enlarges the scope of what was already a comprehensive textbook. These two authors must be congratulated on having produced, within the hundred pages devoted to the section dealing with mental ill-health, a very readable and instructive account of a difficult and somewhat controversial subject. They have succeeded, as is so necessary in a textbook of this type, in steering a middle course between the extremist psychologist and materialistic schools, and have dispensed with most of the obscure words, phrases, and tautologies beloved of the "whole-hogger" psychologists. Their description of schizophrenia is admirable. The legal aspects of mental illness are also adequately dealt with.

The section on tropical infections contributed by Dr. Hugh Stott of Lucknow appears somewhat condensed, only 30 pages being allowed for this important section. In view of the ever-increasing importance of these

so-called tropical infections (few of them are, of course, limited to tropical or even subtropical climes), it is suggested that rather more space be devoted to their description in future editions.

Dr. Stott makes a small slip when he speaks of the human cycle of the malaria parasite as "sporogony," this term being usually confined to the extra-corporeal phase within the anopheles mosquito. He does not mention that the most important therapeutic action of plasmoquine lies in its effect on the relapse rate, especially of benign tertian malaria; nor that atebirin may be given, often advantageously, by intramuscular injection.

In the article on diabetes, contributed by the editor, the uses and abuses of the new insulin compounds have been fully described. As might be expected in a textbook emanating from the school where Sir Arthur Hurst is a presiding genius, the article dealing with the organic disorders of the stomach, although not from the pen of that great little man, is very complete and up-to-date. A description of the more liberal dietetic treatment advocated by Dr. Meulengracht of Copenhagen in the treatment of hæmatemesis, receives full notice.

In the otherwise excellent article on gonorrhœa contributed by Mr. E. V. Lloyd, the revolutionary results obtained in the treatment of that disease with drugs of the sulphanilamide group are not, perhaps, sufficiently stressed. This omission will doubtless be made good in future editions when the therapeutic effects of these new preparations throughout the whole range of venereal infections have been more thoroughly elucidated.

Dr. Geoffrey Marshall and Dr. W. D. W. Brooks have contributed a specially comprehensive and helpful account of pulmonary and pleural tuberculosis, well illustrated by a series of excellent and clearly marked radiograms.

The reviewer read with much interest and no little profit the interesting section dealing with diseases of the nervous system contributed by Dr. F. M. R. Walshe. It is sad to realize how greatly treatment lags behind diagnosis in this interesting but therapeutically disappointing branch of medical science.

Dr. Conybeare, in his account of the worm infections, still retains the old nomenclature, *Trichocephalus dispar* and *Oxyuris vermicularis* instead of the more modern *Trichuris trichiura* and *Enterobius vermicularis*, both of which have been in common usage for some years.

We can do no better in terminating this review of an excellent textbook than mention that it is dedicated to that great benefactor of medicine in all its branches, Lord Nuffield, a good augury for its continued success.

S. S.



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### CONTENTS

	PAGE		PAGE
<b>ORIGINAL COMMUNICATIONS.</b>			
The Laboratory Diagnosis of Weil's Disease. By H. C. BROWN, <i>C.I.E., M.B., D.T.M. &amp; H.</i>	65	Experiment with a Sunlight Clinic. By Major D. W. M. MACKENZIE, <i>R.A.M.C.,</i> and Staff-Serjeant A. F. SMITH, <i>R.A.M.C.</i>	99
Infective Hepatitis and Catarrhal Jaundice. By G. M. FINDLAY, <i>C.B.E., M.D., D.Sc.</i>	72	A Case of Myasthenia Gravis. By Captain R. STJOHN LYBURN, <i>M.D., R.A.M.C.</i>	100
The Problem of Sick Wastage in War. By Lieutenant-Colonel J. R. R. TRIST, <i>M.C., R.A.M.C. (Militia), Retired.</i>	80	Medical Society of the Vth Casualty Clearing Station. President: Colonel F. R. COPPINGER, <i>O.B.E.</i>	103
On the Manipulation of Joints. By Major I. H. LLOYD WILLIAMS, <i>M.C., M.B., R.A.M.C.</i>	86	<b>ECHOES OF THE PAST.</b>	
<b>EDITORIAL.</b>		Twenty Years After. By H. SKIPTON STACY, <i>M.D., Ch.M.(Syd.), F.R.A.C.S.</i>	105
Gas Gangrene	92	<b>CURRENT LITERATURE</b>	112
<b>CLINICAL AND OTHER NOTES.</b>		<b>REVIEWS</b>	114
A Note on the Present Trend of Mastoid Surgery. By W. O. LODGE, <i>F.R.C.S. Edin.</i>	98	<b>CORRESPONDENCE</b>	118
		<b>NOTICES</b>	118

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## A CASE OF SEVERE VESICOVAGINAL FISTULA TREATED BY URETEROCOLIC IMPLANTATION.

BY CAPTAIN A. J. CLYNE,  
*Royal Army Medical Corps.*

SEVERE cases of vesicovaginal fistula are now, thanks to modern obstetric methods, a rarity in civilized countries.

In India, however, despite the excellent work and propaganda of civil and mission hospitals in the larger towns, there still remains a vast population yet in the dark ages of medicine. The unfortunate mother in obstructed labour will usually be treated by the village midwife. After an unsuccessful attempt at manual extraction such well-tried devices as packing the vagina with cow manure and rolling large and heavy stones over the abdomen may be tried. That any such patient ever survives to reach a hospital is a miracle. If more fortunate she will be taken to a practitioner with some Western training and delivered after much unskilled instrumentation. These are the cases that provide the examples of severe vesicovaginal fistula common throughout India.

The surgeon, faced with a severe and probably long-standing vesicovaginal fistula, must consider three possible courses :—

- (1) Leave the patient in her misery, physical and mental.
- (2) Attempt a closure of the fistula. The chances of success here depend on the size of the opening between bladder and vagina, its duration, and the amount of scar tissue present. The region is always grossly infected, and an unsuccessful attempt at closure leaves the patient worse off than ever.
- (3) Attempt a ureterocolic implantation. As an alternative to an attempt at closure in doubtful cases this is in my mind the treatment of choice, as the operation is reasonably safe, not unduly difficult, and the immediate result in the case to be described was excellent.

### CASE REPORT.

The patient, a Hindu woman, aged 25, was first seen at the King Edward Memorial Hospital, Secunderabad, in January, 1939. She gave a history of difficult labour (her first pregnancy) about seven years ago, in which forceps had been used. The child died. Since then she has had continuous dribbling of urine with dyspareunia and dysmenorrhœa. Attempts at intercourse, which was now impossible, caused great pain. She had heard about the hospital in Secunderabad and decided to come in from her village to see if she could be cured.

*Examination.*—She was a well-nourished young woman otherwise sound. Pelvic examination revealed marked cicatricial stenosis of the vaginal outlet which admitted the tip of the index finger only. The little finger

could, however, be introduced up to the second joint, and a large opening between bladder and vagina detected, the tip of the finger just reaching the upper vaginovesical partition. The scar tissue formed a dense ring as hard as cartilage. There was continuous dribbling of urine from the orifice.

It was at once decided that she was inoperable from the point of view of any attempt at repair, and that a ureterocolic implantation offered her the only hope of future comfort.

*First Operation.*—Right ureterocolic anastomosis using a minor modification of Coffey's method was performed on February 2. The abdomen was opened by a mid-line subumbilical incision, the table tilted, and the intestines packed off. The right ureter was exposed as it crossed the pelvic brim, freed down to about  $\frac{3}{4}$  inch from the bladder, divided here and the distal end tied and the peritoneum then closed. This left about 3 inches of the ureter for implantation. The ureter was then implanted into the right posterior wall of the pelvic colon, just above the rectum, by Coffey's method, and the ureter buried for about  $1\frac{1}{2}$  inches in the bowel wall with Lembert sutures. The abdomen was closed and the patient put on free fluids and a urinary antiseptic.

Convalescence was apyrexial and uneventful, and the patient allowed up after fourteen days. There was no noticeable change in the amount of urine dribbling, but her motions were now mixed with urine.

*Second Operation.*—This was performed three weeks later and the left ureter similarly implanted into the left side of the colon posteriorly at a slightly higher level. The right anastomosis on inspection was completely satisfactory.

The patient was again put on free fluids and a urinary antiseptic, and again convalescence was apyrexial and uneventful. Dribbling of the urine *per vagina* of course ceased at once. Urine at first drained freely from the anus, but the rectum rapidly became tolerant to it and sphincter control returned, so that by the time of her discharge from hospital three weeks after the second operation, she could retain her urine about three to four hours. Her sphincter control became very good and she had no trouble in retaining it.

Pelvic examination prior to discharge showed that the vaginal outlet had become much softer and now admitted two fingers by which the bladder and vagina could be explored.

The patient returned to her village delighted with the result; in fact the remarkable change in her general mental outlook after the second operation was one of the most gratifying features of the case.

#### DISCUSSION.

The immediate result in this case left nothing to be desired, but of the ultimate prognosis one must be more cautious. The textbooks say that the danger in such cases is that an ascending ureteric infection is likely to occur sooner or later, but as most examples would appear to be based on

the experience of the similar operation for ectopia vesicæ and the two are not quite comparable, it is difficult to make a prognosis. In this case the woman returned to her village and was told to report again in three months. This she is most unlikely to do if she is feeling well. Shortly afterwards I was transferred to another station, so I shall never hear of her again.

In conclusion I would say that in my opinion the excellent immediate result justified the operation, and I see no reason to be pessimistic about the remote results.

I wish to express my thanks to Lieutenant-Colonel R. F. D. MacGregor, M.C., I.M.S., late Residency Surgeon, Hyderabad, for his permission to send these notes for publication and for his kindness in giving me facilities to operate on this and other cases at the King Edward Memorial Hospital, Secunderabad.

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## Echoes of the Past.

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### TWENTY YEARS AFTER.

BY H. SKIPTON STACY, M.D., Ch.M.(Syd.), F.R.A.C.S.

*Honorary Consulting Surgeon at Sydney Hospital, Ryde Hospital, and Royal South Sydney Hospital.*

(Continued from p. 380, No. 6, vol. lxxiii.)

#### II.—GUNSHOT WOUNDS OF THE CHEST.

##### CASE 10.—Hæmothorax from Wound of Subclavian Vein.

*Clinical History.*—Nature of wound : Gunshot wound, chest.

Signs and symptoms : Struck on chest. Wound leading to comminuted fracture of the right clavicle ; no exit wound. Temperature 97° F. on admission, later in the day 101° F., pulse 110. Next day signs of left hæmothorax. Temperature 103° F., pulse 110, respirations 56 to 66 ; is very distressed. Next day spitting up blood-stained sputum ; not offensive. Temperature 101° F., pulse 110, respirations 40. Thought to have a small hæmothorax and apical pneumonia. Next day temperature 100° F., pulse 106, respirations 42. Apex beat one and a half inches outside nipple line. Next day very dyspnoëic ; temperature sub-normal. Died.

Operation : Wound excised under local anæsthetic.

Survival : About ninety-six hours.

*Post-mortem Result.*—Chest : Comminuted fracture of the right clavicle with a wound of the right subclavian vein. The right pleura absolutely full of blood, thin, not clotted. Upper lobe of the right lung was solid, very dark red in colour (? red hepatization or concussion hæmorrhage) ; the rest of the lung collapsed. Left lung a little congested.

Pathological report : Section of portion of the upper lobe of the right lung shows extensive hæmorrhage in the lung tissue, the cause of which is

not apparent. No evidence of pneumonia. (No. 5 Canadian Mobile Laboratory.)

CASE 12.—Hæmothorax and Laceration of Spleen. Wound of Heart.

*Clinical History.*—Nature of wound: Gunshot wound, chest and abdomen.

Signs and symptoms: Admitted 3 a.m.; died immediately on admission.

*Post-mortem Result.*—Chest: Wound in the left chest is in the anterior axillary line, through the 6th rib into the pericardium and apex of the left ventricle; in the pericardium there was about two and a half ounces of blood. The left pleura was full of blood and the lung was collapsed; the margins of the lower lobe were filled with blood for about two inches; could see no actual wound; attribute it to concussion hæmorrhage. (We see it in every case of chest injury.) The diaphragm is depressed. The right side of the chest was normal.

Abdomen: There is a wound in the left flank. The spleen is much lacerated; much blood-clot tracking down the wall of the descending colon, which was not perforated. There was a handful of blood-clot around the spleen, and about a teacup full of blood free in the peritoneal cavity. Presumably during the collapse the hæmorrhage stopped somewhat. Did not trace the wound in the flank, but it was the exit wound of the chest missile; there was a track of blood-clot down from the wound in the diaphragm to the left of the liver and stomach into the left flank.

CASE 13.—Wound of the Lung and Liver. Shock.

*Clinical History.*—Nature of wound: Shell wound of chest and abdomen. Other multiple wounds.

Signs and symptoms: Extremities cold, pulse feeble, respirations rapid.

Operation: Operated on shortly after admission owing to multiple wounds which were excised (including one of the pericranium). The wound of the chest wall was excised and drainage tube inserted. Very shocked that night; never recovered properly.

Survival: About twenty-four hours.

*Post-mortem Result.*—Chest: A penetrating wound of the right pleural cavity in the posterior axillary line, through the 8th interspace and upper edge of the 9th rib, grazing the base of the lung and going through the diaphragm into the convex surface of the right lobe of the liver, penetrating a little distance. (Foreign body not found.) The liver substance had bulged into the wound of the diaphragm, shutting off the peritoneal cavity; around the point of entrance there were many small lacerations and hæmorrhages. A little blood in the right pleural cavity; right lung slightly collapsed; around the site of the pleural abrasion on the base was a wedge-shaped area of hæmorrhage into the base of the lung. Both lungs œdematous; the left slightly emphysematous. Some serous fluid in the left pleural cavity. A little dark blood free in the peritoneal cavity. Liver somewhat blanched. Spleen small and normal looking.

## CASE 16.—Hæmothorax with Gas Infection. Wound of Liver.

*Clinical History.*—Nature of wound : Gunshot wound, chest.

Signs and symptoms : Wound lateral to the right nipple line ; oozing freely. Temperature on admission 98° F., respiration 36. Next day felt easier. Temperature 102° F., pulse 120, respiration 36. Abdomen appears to be normal, though he complains of pain over the epigastric region. Several days later he appeared to be improving. Examination of the chest showed impairment of resonance in the lower part of the right side ; breath sounds slightly diminished in this area. Heart : Apex beat about normal in position. Temperature 100° F., pulse 140, respiration 42. About eight ounces of dark foul-smelling blood taken from the right chest. Died next morning with a temperature of 98° F. and pulse 120.

Survival : Four days.

*Post-mortem Result.*—Chest : The wound through the chest wall was in the fourth right interspace in the anterior axillary line, chipping off the upper border of the 5th rib. The pleural cavity contained some foul gas, and was half full of dark liquid blood with an offensive odour. The lung was covered with a thick membrane which could be pulled off. (? fibrin from the blood or exudate.) This was also present on the diaphragmatic pleura. On the diaphragm was found a small piece of bone, and near this, a hole about the size of sixpence in the diaphragm ; this led into a wound of the upper surface of the right lobe of the liver ; this was continued as a track two inches long under the surface, coming out again. There was no sign of a foreign body, and no sign of hæmorrhage in the peritoneal cavity. (Presumably as usual the diaphragm contracted on the wound in the liver.) The lung was much collapsed and airless.

Comment : The temperature was again unreliable as a guide to the condition ; the pulse and respirations were more valuable. Thirty-six hours before death it struck me he was not doing too well ; his breathing was very rapid. The gas in the pleural cavity made the resonance more marked than it would otherwise have been, and was misleading as to the amount of hæmothorax.

Pathological report : Blood from chest. Aerobic culture : *Staphylococcus*. Anaerobic culture : Gram-positive capsulatus gas-forming bacillus, probably *Bacillus aerogenes capsulatus*.

## CASE 30.—Hæmothorax and Secondary Hæmorrhage.

*Clinical History.*—Nature of wound : Gunshot wound, chest.

Signs and symptoms : Hit near the left axilla with shrapnel ; in the course of the first two days he got very pale. Temperature rose to 102° F., pulse 120 ; after that temperature dropped to normal, but the pulse remained about 120 ; colour very pale. He was aspirated, and forty ounces of dark offensive blood was withdrawn ; several ounces of Eusol were introduced ; after this he was more comfortable. Twenty-four hours later he was operated upon ; did well for that day, but died next morning from hæmorrhage.



Survival : About three and a half days.

Operation : Under local and light general anæsthesia the 7th rib was resected, foul smelling blood evacuated and Eusol washed through from the tube in the wound of entrance in the axillary region out through the lower tube.

*Post-mortem Result.*—Chest : A coating of fibrin over the parietal and visceral pleura ; lung collapsed to half its size ; in the lower lobe a large piece of shrapnel lay loosely embedded in the lung ; evidently from here the hæmorrhage had proceeded (! either from pressure erosion, or from septic ulceration of a vessel). Blood-clot in the pleural cavity.

Comment ; He had always been too ill to be removed for X-ray. (Rarely is it of much importance to locate the foreign body in chest cases ; here possibly removal might have saved his life.)

CASE 33.—Hæmopneumothorax and Lobar Pneumonia. Gas Infection of Wound.

*Clinical History.*—Nature of wound : Gunshot wound, chest. (Shrapnel.)

Signs and symptoms : Hit with shrapnel just below left axilla ; no wound of exit ; also gassed. On admission temperature 97° F., pulse 126. Dyspnœic. Colour, pale ; somewhat collapsed. Left side of the chest resonant, but was not examined much. Given oxygen for fifteen minutes every hour through a nose-piece with relief. Next day temperature 103° F., pulse 122. Colour much improved though is still very dyspnœic. Next day temperature 101° F., pulse 146. Heart displaced to the right of the sternum ; left side of chest resonant ; breath-sounds not heard. Over the right upper lobe breath-sounds puerile (probably pneumonic, Colonel Rigby thought). He also had gas infection of his wound ; coppery discoloration of the skin and emphysema spreading down the chest wall.

Slightly improved in the afternoon after the operation but still very ill ; dyspnœic and restless. Next morning temperature 98° F., pulse 132, colour bluish. Is very restless. Died the same evening. Unconscious for the last seven or eight hours ; colour livid. Tube was draining well ; discharge from it not offensive. Gas gangrene of the chest wall not extending, in fact was improving.

Operation : Under light open ether the chest wound was excised. The wound through the fractured rib was enlarged and almost two pints of dark blood (frothy and inodorous) were evacuated. A tube stitched in. Gas gangrene area of the chest wall freely incised, and a Eusol dressing applied.

Survival : About fifty-six hours.

*Post-mortem Result.*—Chest : Wound of the chest wall leading through the left 7th rib at the posterior axillary line ; a little blood in the pleural cavity. The lung was partly collapsed ; anterior surface covered with adherent lymph. Lower lobe pneumonic, most intense nearest the site of the perforating wound which went through the outer border of the lower lobe and came out at the base. The right lung extremely congested, otherwise normal.



Heart : Perhaps slightly to the right, but not much ; no evident lesion. Some ante-mortem clots in both ventricles, aorta, and pulmonary artery. No wound of the diaphragm seen. No foreign body found in the pleural cavity. Abdomen normal.

CASE 38.—Wound of Liver and Haemopneumothorax.

*Clinical History.*—Nature of wound : Gunshot wound, chest and arm. (Shrapnel.)

Signs and symptoms : Hit with shrapnel on the left costal margin, just to the left of the mid-line ; wound of exit is about two inches to the right of the right nipple ; there is also a lacerated wound through the right upper arm in the track of the same missile. He coughed up about two ounces of blood before admission. He is extremely pale and collapsed. Temperature subnormal. Chest : There is a churning noise in the right chest occasionally, as of air and blood mixed ; much oozing from the right chest wound. No definite surgical emphysema felt. Abdomen rigid. Decided to give him morphia, and rest in a semi-recumbent position. Next morning he felt better ; abdomen less rigid. He was thought to be a case of haemopneumothorax, with a possible wound of the liver. Later on that day his abdomen became somewhat distended, especially in the suprapubic region ; flanks resonant ; liver dullness mostly gone. Temperature 96° F., pulse 148. Is unconscious and dying.

Survival : About thirty-six hours.

*Post-mortem Result.*—Neck, chest and abdomen : There is some surgical emphysema in the right side of the neck. The wound in the abdominal wall is at the tip of the 8th costal cartilage, about one and a half inches from the mid-line ; it leads along the anterior surface of the liver at its junction with the superior surface ; in situ it looked comparatively superficial, and the liver herniated through a hole in the diaphragm (size of half a crown) into the right pleural cavity ; when the liver was removed the wound was seen to be both extensive and deep. The wound of exit was through the 6th intercostal space in the anterior axillary line (about one and a half inches below the nipple line and two and a half inches external). The lung was partly collapsed, containing blood in its lower lobe, especially near the base, but it showed no trace of wound. The pleural cavity contained quite twelve to fifteen ounces of blood ; the dark semi-solid condition of the lung was either the result of the compression exerted by the haemopneumothorax, or, as it was definitely haemorrhagic in its lower part, perhaps due to concussion haemorrhage. There was some surgical emphysema in the mediastinum. The abdomen contained about half a pint of blood in the flanks and in Douglas' pouch. There was no free gas in the peritoneal cavity. The loss of liver dullness was due to the colon being pushed up under the liver. The stomach contained a quantity of dark fluid (probably not blood, as there was no wound). The pericardium was normal.

Arms : The brachial artery and median nerve were uninjured.

CASE 46. — Hæmothorax and Hæmoperitoneum with Gas Infection.  
Laceration of Lung.

*Clinical History.*—Nature of wound : Gunshot wound, chest.

Signs and symptoms : Hit in the back just to the left of mid-line about the 6th or 7th rib, fracturing it and penetrating the thorax. Dyspnœa on admission ; relieved in semi-recumbent position. Next day pale and very dyspnœic. Breath sounds audible over the front and lower part of the left chest, though not so loud as on the right side ; too bad to examine the back of the chest. An exploring needle was put in on both sides ; negative result. Died later in the day.

Survival : About thirty hours.

*Post-mortem Result.*—Chest : Left lung partly adherent, but pleural cavity absolutely full of dark blood, which was clotted in places. All except the apex of the left lung was disorganized ; the lung was much lacerated and practically absent in parts ; in what was left of it (with the exception of the apex) there was nothing but dark blood. There was a hole in the diaphragm just to the left of the left lobe of the liver, and in front of the spleen. The other lung was normal ; no sign of collapse.

Abdomen : Free dark blood in the peritoneal cavity, but could find no visceral lesion.

Bacteriological report : Films made from the hæmothorax were heavily infected with the *Bacillus aerogenes capsulatus*.

Comments : The state of the lung was worse than in two previous autopsies of gunshot wound of the chest, where the lung was totally adherent and there was no blood in the pleural cavity. The patient also lived longer, though not so long as those cases of hæmothorax pure and simple (without much hæmorrhage into the lung), which die of infection. Presumably the aspirating needle struck the blood clot, hence the negative result.

CASE 57.—Laceration and Hæmorrhage into Lung.

*Clinical History.*—Nature of wound : Gunshot wound, chest.

Signs and symptoms : Wounds on both sides of chest as the result of a raid. Cold, pulseless and pale.

Survival : About an hour.

*Post-mortem Result.*—Chest : The left chest was entered behind the posterior axillary line, furrowing the posterior wall of the chest on the inner side of the ribs and wounding the lower lobe of the left lung ; the lacerated lung contained several small pieces of bone, but no shrapnel. The whole lung was densely adherent all over (old) ; the lower lobe was solid with hæmorrhage ; the upper lobe a little congested. Right lung normal. Heart : Right auricle and ventricle much dilated.

Abdomen : Normal.

Comments : What the cause of death ? Was it due to the adherent pleura, in consequence of which he bled into the lung instead of into the pleural cavity ?

## CASE 60.—Hæmopneumothorax.

*Clinical History.*—Nature of wound : Gunshot wound, chest.

Signs and symptoms : Hit in the upper part of the left chest ; a through-and-through wound coming out through the scapula. Developed a hæmopneumothorax. Was aspirated a day or two after admission, some blood and air drawn off ; this gave relief. Bacteriological report was negative. A day or two later aspirated again : this rather knocked him out ; air came straight through from the lung. Temperature became pretty high subsequent to this, and remained up until death. Aspirated again a day or two later ; died shortly after.

Survival : About five or six days.

*Post-mortem Result.*—Chest : Marked bronchitis on both sides. There was a track through the upper lobe of the left lung, surrounded by blood-clot, which in one part had become converted into an abscess. The wound in the lung still communicated with the pleura, and there was a good deal of hæmothorax. Some bronchopneumonia in the lung surrounding the wound track.

Bacteriological examination : (1) Mucopus from the bronchi contained small bacilli like influenza bacilli, also streptococci ; (2) pus from the lung abscess contained streptococci ; (3) film from the hæmothorax contained streptococci.

Comments : Possibly the suction of aspiration kept open the wound of the lung, and caused infection of the hæmothorax from the bronchi.

## CASE 61.—Hæmothorax and Hæmorrhage into Lung.

*Clinical History.*—Nature of wound : Gunshot wound, chest.

Signs and symptoms : A through-and-through wound entering the upper part of the right chest anteriorly, and coming out through the scapula behind.

Survival : About forty-eight hours.

*Post-mortem Result.*—Chest : The right lung was adherent in places, but he had a good-sized hæmothorax ; also some hæmorrhage into a moderate area of lung substance.

Bacteriological examination : Film from the hæmothorax showed a Gram-positive coccus, chiefly in pairs.

## CASE 62.—Bilateral Hæmothorax and Infective Pericarditis.

*Clinical History.*—Nature of wound : Gunshot wound, chest. (Shrapnel bullet.)

Signs and symptoms : Hit in the left shoulder, penetrating the 3rd intercostal space. Left pleural cavity aspirated, a tube put in through an intercostal space, and washed out with Eusol every six hours.

Survival : Several days.

*Post-mortem Result* : Chest : The track of the bullet was through the 3rd interspace, through the left lung, and then through the upper and posterior part of the pericardium, then across the upper surface of the right

dome of the diaphragm, contusing it. There were recent fibrinous adhesions of the left lung, shutting off clear brownish fluid in other parts of the pleura from the drainage tube. The left lung was somewhat collapsed, but otherwise healthy. There is some turbid fluid in the pericardial sac ; some fibrin over the heart which was much dilated. In the right pleura there was a good-sized hæmothorax ; the shrapnel bullet was lying at the bottom of the cavity.

Abdomen : Some blood on the under surface of the right side of the diaphragm ; also extending from there into the pelvis. (This blood and the hæmothorax are apparently due to the contusion ; could see no actual open wound.)

Bacteriological examination : Films from the left pleura during life showed an organism like *Bacillus aerogenes capsulatus* ; culture showed streptococci. Films from the right pleura taken at the autopsy showed Gram-positive cocci, mostly in pairs ; also some short chains. Pericardial fluid taken at the autopsy contained Gram-positive cocci, mostly in pairs ; also short chains. Film from the left pleura taken at autopsy showed no organism ; the previous positive finding from the left pleura was during life. It looks as if the Eusol had been quite effective.

#### COMMENTS MADE IN 1937 AFTER REVIEWING THE NOTES.

*Hæmothorax.*—In practically every case this was due to injury to the lung (or chest wall), but in one case, No. 10, it was due to a wound of the right subclavian vein. Case 10 illustrates that an exploring needle (in spite of its occasional failures) would have revealed the most disabling factor in this case, viz., hæmorrhage ; although, of course, it would not have revealed its origin. A bacteriological examination would have revealed that, in spite of the fact that the temperature was 103° F., there was no infection.

I do not think even good portable X-rays will ever replace a decent-sized aspirating needle.

Recognition of the fact that No. 10 was bleeding from the subclavian vein would have saved him.

The signs and symptoms of hæmorrhage to this day are not always clearly recognizable. A high leucocyte count is not usually expected, yet I have seen a big abdominal hæmorrhage with a count of 30,000.

As to the treatment of hæmothorax (when uninfected) varied opinions were expressed at the meeting of the Second Army Medical Society in Ballieul in 1916. I expressed myself in favour of aspiration at the C.C.S. or shortly after arrival at the Base, so as to avoid long-standing compression of the lung. This view was also taken by most of those who had seen the cases at Base Hospitals in England, particularly those with post-mortem experience.

*Infection of Hæmothorax.*—This was a frequent cause of death ; the infecting organism was usually *B. aerogenes capsulatus*, as in Cases 62, 46, 33, 30, and 16 ; occasionally a mixed infection. Those cases which escaped

infection, or where it was of a milder nature, were evacuated to the Base. The cases with gas infection were usually quickly fatal. (As it is more often a toxæmia rather than a septicæmia, it is possible that it would be amenable to frequent irrigation with Eusol, Dakin's, etc.) Sometimes the infection came from the man's own lung, e.g. where he was the victim of bronchitis (not an uncommon affection in that severe winter of 1916-17). In Case 60, where the lung of a man with bronchitis had been wounded, there was bronchopneumonia around the wound track and abscess formation at one part; the infecting organisms in the case were bacilli like influenza bacilli, and streptococci. Several cases have been recorded lately of streptococcal empyema treated by injection of 5 cubic centimetres of Prontosil into the pleural cavity. In these cases the improvement was immediate and the recovery complete.

*Hæmopneumothorax.*—This was met with occasionally; the air came either from the wounded lung or from without. It was later recognized that in gunshot wound of the chest it was essential as soon as possible to put a copious dressing over the wound to prevent this pneumothorax, which in the case of large wounds may cause collapse of the affected lung and a "flapping mediastinum"—fatal in its effect. Subsequent to the War, Graham worked out, on mathematical principles, that the largest opening compatible with life in a healthy adult is about two by four inches.

In hæmopneumothorax or in gas-infected hæmothorax, the resulting resonance is sometimes misleading; it conceals the extent of the hæmothorax. Case 16 is illustrative of this point.

*Gas Infection.*—The importance of either immunization against gas infection, or efficient treatment of it by serum, is emphasized in this series of cases where—apart from the appalling mortality of gas infection itself—cases of multiple flesh wounds were subjected to excision for fear of gas infection; in some of these, the presence of a chest complication such as an uninfected hæmothorax (which would otherwise have recovered) was sufficient to turn the scale against the patient.

*Aspiration.*—This (which is one of the most useful adjuncts of chest surgery) in Case 46 was misleading, due to the fact that it struck blood-clot; it withdrew nothing.

*Surgical Emphysema.*—This was not common. Case 38 was unusual. It showed emphysema on the right side of the neck at the autopsy, also in the mediastinum; presumably this had been entered by the missile. The air came either from the wound of exit in the chest wall, or from the lung (in which, however, no wound could be found).

*Injury to Rib.*—In some cases portions of the rib were driven into the lung.

*Temperature and Pulse.*—In chest cases, as in every other part of the body, the pulse was a much better guide than the temperature.

*Thoraco-abdominal Injuries.*—These were not uncommon; in most cases the missile went from the chest into the abdomen (from above downwards).

*Hæmorrhage into the Lung.*—Over and over again we find this associated in some cases with a wound of the lung, in others merely due to concussion from the adjacent passage of the missile. Case 62 is a case in which there was a contusion of the upper surface of the diaphragm from the grazing of a shrapnel bullet (found at the bottom of the pleural cavity). Yet there was some blood in the peritoneal cavity; some of it had gravitated down into the pelvis. Where the lung was adherent to the parietal pleura and the blood could not escape into the pleural cavity death seemed to come on more quickly. Case 57 seems a case in point. In Case 46, in which the lung was partly adherent, it was so disorganized that only the apex could be recognized as lung tissue.

*Heart Wounds.*—These were uncommon; most would die on the field. We had one case, No. 12, which had a wound on the left ventricle, together with hæmothorax and lacerated spleen; he died shortly after admission. There was one case in which the pericardium was in the track of the missile; this was not suspected during life; it showed streptococcal infection similar to the pleura. Whether it would have responded as well to the Eusol irrigation as the adjoining pleura did, is, of course, a matter for conjecture; or whether Prontosil (or allied drugs) injections in cases of streptococcal pericarditis of the future will help, I cannot say.

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## Current Literature.

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WATER WORKS AND SEWERAGE. 1938, v. 85, 1130. **Galvanic Corrosion Stopped by Water Treatment.** [Summary taken from *Pub. Health Engineering Abstr.* Washington. 1939, May 13, v. 19. Signed R. E. Tarbett.]

“Experimental work under way by the Division of Sanitary Engineering of the Department of Public Health of Massachusetts is revealing that, in spite of corrective treatment of the water, galvanic action continues to occur in piping systems wherein dissimilar metals are brought together. Combinations of nine different kinds of service pipes (including those in common use to-day) have been immersed in raw surface and ground waters and in surface and ground waters treated to prevent corrosion. Results to date indicate that treatment with soda ash or lime has little or no effect on corrosion caused by galvanic action. Therefore, it is apparent that treatment of the water at the source is only effective in preventing corrosion at joints when a uniform kind of pipe is used in the distribution system and services. The conclusion is that anti-corrosion treatment does not prevent corrosion of services where pipes of dissimilar metals are used in contact with each other.”

*Reprinted from “Bulletin of Hygiene,” Vol. 14, No. 9.*

GLOVER, B. T. J. **The Use of Heavy Naphtha in Bed-Bug Disinfestation.**  
*J. Roy. San. Inst.* 1939, v. 59, 671-80.

This article deals with the use of washed heavy naphtha by the Liverpool authorities for bed-bug eradication in unoccupied, empty dwellings. Since 1937, 849 houses and 645 tenements had been treated with, it is claimed, only six instances of failure at the first application of naphtha.

A thorough description of the procedure for fumigation is given. First, the house is sealed and then, if outside temperature is below 65° F., it is warmed by primus stoves burning paraffin. The concentration of vapour lethal for bugs after eighteen hours' exposure is 0.15 per cent, and for this to be obtained 50° F. is necessary. For practical purposes, however, 60° F. should be the minimum temperature during fumigation. To minimize fire danger, the stoves are removed and their numbers checked and the gas is turned off at the meter. Then screens of cotton cloth on to which naphtha is to be sprayed are hung 4 in. from the walls on wooden frames. Old blankets or sacks are placed across the roof-space floor and sprayed with naphtha and the cock-loft door is sealed. Spraying is then continued, from the top of the house to the bottom, keeping the door of the room closed during the operation. In badly infested rooms and in corners in passages where the erection of screens is inconvenient the liquid is squirted with a syringe into the harbourages. One gallon of naphtha per 750 cubic feet of space is used. The operators leave by the door of the last room to be treated. The delayed action sprinkler described in a previous review (*Bulletin of Hygiene*, 1938, v. 13, 308) has not been used in Liverpool.

After eighteen to twenty-four hours the house is opened and ventilated, when the vapour clears with great rapidity. There is no tendency for concentrations to "build up" on closing the house after ventilation.

It is the opinion of the writer of the article that heavy naphtha vapour is not harmful to human beings, for there have been neither obvious ill-health nor complaints from the fourteen men employed in the work during the last two years. Damage to paint work and redecoration costs are minimized by the use of cotton screens. The importance of a well-trained and disciplined staff, who must take meticulous care with every detail of procedure if suitable concentrations of vapour are to be maintained, is stressed. It is found that a team of three men can fumigate one house a day. Liverpool, with four such teams, fumigate approximately twenty houses a week at an average cost of £5 12s. 4d. per house.

Results of fumigation are checked four times before the end of the first month's tenancy—immediately after fumigation, then by the decorators and by two subsequent inquiries. In the author's words (rather sanguine to the abstractor): "If no evidence of bugs comes to light before the end of the first month of the new tenancy, it is certain that the treatment has been completely successful."

The article contains a useful list of the necessary materials for naphtha fumigation with their sources and costs.

C. JOHNSON.

*Reprinted from "Bulletin of Hygiene," Vol. 14, No. 9.*

## Reviews.

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**ASTHMA.** Second Edition. By Frank Coke, F.R.C.S., with the collaboration of Harry Coke, M.R.C.S., L.R.C.P. Bristol: John Wright and Sons Ltd. 1939. 20 illustrations. Pp. xii + 258. Price 15s.

The second edition of this book, published sixteen years after the first, has been completely revised in the light of the author's experience gained in this period, and of much important work into the factors involved in the causation of asthma and their mode of action. Following a preliminary description of allergy, anaphylaxis, and sensitization, the author gives in full detail the ætiological factors involved, and proceeds to describe the investigation of a case from the standpoints of heredity, history, sensitivity, bacteriology, and blood cytology and biochemistry. He distinguishes three main types of asthma—allergic, microbic, and a mixed type which includes the aspirin-sensitive group. The erythrocyte sedimentation rate and the differential sedimentation test, which is fully described, are used in the differentiation of the three types, and in prognosis and control of treatment. Finally, the treatment of the three types is discussed.

The book is attractively written and presents concisely, and with ample references to the literature, an interesting and instructive and comprehensive treatise on the present knowledge on the subject. T. M.

**TEXTBOOK OF MEDICINE.** By Various Authors. Edited by J. J. Conybeare, M.C., D.M.Oxon., F.R.C.P. Fourth Edition. Edinburgh: E. and S. Livingstone. 1939. Pp. xvii + 1112. Price 21s. net.

- The fact that four editions and two reprints of "Conybeare" have appeared within the short space of ten years is sufficient evidence of its continued popularity.

The whole work has been brought thoroughly up to date, and a section dealing with psychological medicine, contributed by Dr. Desmond Curran and Dr. Eric Guttman, introduced for the first time into this edition, enlarges the scope of what was already a comprehensive textbook. These two authors must be congratulated on having produced, within the hundred pages devoted to the section dealing with mental ill-health, a very readable and instructive account of a difficult and somewhat controversial subject. They have succeeded, as is so necessary in a textbook of this type, in steering a middle course between the extremist psychologist and materialistic schools, and have dispensed with most of the obscure words, phrases, and tautologies beloved of the "whole-hogger" psychologists. Their description of schizophrenia is admirable. The legal aspects of mental illness are also adequately dealt with.

The section on tropical infections contributed by Dr. Hugh Stott of Lucknow appears somewhat condensed, only 30 pages being allowed for this important section. In view of the ever-increasing importance of these



so-called tropical infections (few of them are, of course, limited to tropical or even subtropical climes), it is suggested that rather more space be devoted to their description in future editions.

Dr. Stott makes a small slip when he speaks of the human cycle of the malaria parasite as "sporogony," this term being usually confined to the extra-corporeal phase within the anopheles mosquito. He does not mention that the most important therapeutic action of plasmoquine lies in its effect on the relapse rate, especially of benign tertian malaria; nor that atebirin may be given, often advantageously, by intramuscular injection.

In the article on diabetes, contributed by the editor, the uses and abuses of the new insulin compounds have been fully described. As might be expected in a textbook emanating from the school where Sir Arthur Hurst is a presiding genius, the article dealing with the organic disorders of the stomach, although not from the pen of that great little man, is very complete and up-to-date. A description of the more liberal dietetic treatment advocated by Dr. Meulengracht of Copenhagen in the treatment of hamatemesis, receives full notice.

In the otherwise excellent article on gonorrhœa contributed by Mr. E. V. Lloyd, the revolutionary results obtained in the treatment of that disease with drugs of the sulphanilamide group are not, perhaps, sufficiently stressed. This omission will doubtless be made good in future editions when the therapeutic effects of these new preparations throughout the whole range of venereal infections have been more thoroughly elucidated.

Dr. Geoffrey Marshall and Dr. W. D. W. Brooks have contributed a specially comprehensive and helpful account of pulmonary and pleural tuberculosis, well illustrated by a series of excellent and clearly marked radiograms.

The reviewer read with much interest and no little profit the interesting section dealing with diseases of the nervous system contributed by Dr. F. M. R. Walshe. It is sad to realize how greatly treatment lags behind diagnosis in this interesting but therapeutically disappointing branch of medical science.

Dr. Conybeare, in his account of the worm infections, still retains the old nomenclature, *Trichocephalus dispar* and *Oxyuris vermicularis* instead of the more modern *Trichuris trichiura* and *Enterobius vermicularis*, both of which have been in common usage for some years.

We can do no better in terminating this review of an excellent textbook than mention that it is dedicated to that great benefactor of medicine in all its branches, Lord Nuffield, a good augury for its continued success.

S. S.

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### CONTENTS

	PAGE		PAGE
ORIGINAL COMMUNICATIONS.		Experiment with a Sunlight Clinic. By Major D. W. M. MACKENZIE, <i>R.A.M.C.</i> , and Staff-Serjeant A. F. SMITH, <i>R.A.M.C.</i> . . . . . 99	
The Laboratory Diagnosis of Weil's Disease. By H. C. BROWN, <i>C.I.E.</i> , <i>M.B., D.T.M. &amp; H.</i> . . . . . 65		A Case of Myasthenia Gravis. By Captain R. STJOHN LYBURN, <i>M.D., R.A.M.C.</i> . . . . . 100	
Infective Hepatitis and Catarrhal Jaundice. By G. M. FINDLAY, <i>O.B.E., M.D., D.Sc.</i> . . . . . 72		Medical Society of the Vth Casualty Clearing Station. President: Colonel F. R. COPPINGER, <i>O.B.E.</i> 103	
The Problem of Sick Wastage in War. By Lieutenant-Colonel J. R. R. TRIST, <i>M.C., R.A.M.C.</i> ( <i>Militia</i> ), Retired. . . . . 80		ECHOES OF THE PAST.	
On the Manipulation of Joints. By Major I. H. LLOYD WILLIAMS, <i>M.C., M.B., R.A.M.C.</i> . . . . . 86		Twenty Years After. By H. SKIPTON STACY, <i>M.D., Ch.M.(Syd.), F.R.A.C.S.</i> 105	
EDITORIAL.		CURRENT LITERATURE . . . . . 112	
Gas Gangrene . . . . . 92		REVIEWS . . . . . 114	
CLINICAL AND OTHER NOTES.		CORRESPONDENCE . . . . . 118	
A Note on the Present Trend of Mastoid Surgery. By W. O. LODGE, <i>F.R.C.S. Edin.</i> . . . . . 98		NOTICES . . . . . 118	

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THE LABORATORY DIAGNOSIS OF WEIL'S DISEASE.

By H. C. BROWN, C.I.E., M.B., D.T.M. & H.

(From the Wellcome Bureau of Scientific Research, London.)

WEIL'S disease or spirochætal jaundice is characterized by fever, hæmorrhages from the nose and kidneys, abdominal pain, vomiting, conjunctival congestion, intense muscular pains, and jaundice on or about the fifth day after onset. Jaundice is not always present and occasionally the disease may be so mild that it is only known to have occurred when agglutinins are subsequently demonstrated in the blood of the patient. The disease is due to infection with *Leptospira icterohæmorrhagiæ*; this organism occurs in the kidneys of up to 40 per cent of British brown rats and to a smaller extent in the black rat. The incubation period is generally in the neighbourhood of ten days but may vary between four and nineteen days (Schüffner, 1934). The mortality in 142 consecutive cases with jaundice was 15 per cent (Alston and Brown, 1937). It is essentially an occupational disease affecting persons who have come into intimate contact with the excreta of infected rats. Sewer workers, miners, fish workers, and canal workers are especially liable to contract the disease. Cases due to bathing in infected rivers are frequently met with.

A disease which is constantly being confused with Weil's disease is infectious or catarrhal jaundice. This occurs both sporadically and in widespread epidemics, chiefly affecting children. All degrees of severity up to a fatal termination may be met with. A severe case of this disease is hard, if not impossible, to diagnose clinically from Weil's disease.

Ocular congestion has been regarded by some as being of diagnostic importance; it is, however, frequently met with in both diseases.

The differential blood-count is of the utmost importance in differentiating the two diseases.

In Weil's disease there is a high polymorphonuclear count associated with a marked leucocytosis, and in infectious catarrhal jaundice, provided there is no septic focus, a leucopenia, and a high mononuclear count.

A typical count in Weil's disease would be :—

Polymorphonuclears	..	..	..	..	..	85
Small lymphocytes	..	..	..	..	..	11
Large mononuclears	..	..	..	..	..	3
Eosinophiles	..	..	..	..	..	1
						—
						100

whereas in catarrhal jaundice we should expect to find a count such as :—

Polymorphonuclears	..	..	..	..	..	55
Small lymphocytes	..	..	..	..	..	42
Large mononuclears	..	..	..	..	..	1
Eosinophiles	..	..	..	..	..	2
						—
						100

The cause of epidemic catarrhal jaundice or infective hepatitis is most probably a filtrable virus, *cf.* Findlay, MacCallum and Murgatroyd (1939); it has nothing whatever to do with leptospira.

Numerous observers, more especially Swan and McKeon (1938) have drawn attention to the high blood urea figure in Weil's disease and conclude that a grave prognosis must be attached to a blood urea figure of over 200 mg. per 100 c.c.

#### THE ISOLATION OF LEPTOSPIRA FROM THE PATIENT.

(1) *From the Blood.*—(a) By direct centrifugalization (Schüffner's technique) suitable in the first week of the disease. To 2 or 3 c.c. of blood add 0.25 c.c. of 20 per cent citrate in saline, centrifuge at 1,500 revolutions for five minutes, remove the supernatant fluid and spin this down at 1,500 revolutions for ten minutes. To the supernatant fluid add saponin to a total concentration of 1 : 1,000, then spin at 3,000 revolutions for half an hour. The deposit is then examined microscopically using dark-ground illumination. Using this procedure, Schüffner was able to give serum in the case of a laboratory infection within a few hours of the onset of the disease with striking result.

(b) By blood culture. During the first ten days of the disease a few drops of the patient's blood are inoculated into a modified Fletcher's medium consisting of 3 c.c. distilled water, 0.5 Lemco broth pH 7.4; to this, after autoclaving, is added 0.25 c.c. of inactivated rabbit's serum passed through

a Seitz filter. The cultures are incubated at 30° C. Growth occurs in three or four days. The serum of different rabbits appears to vary very much in the suitability for making this medium.

In making subcultures massive inoculation is necessary, the carrying over of one platinum loopful is not satisfactory.

(c) By animal inoculation during the first ten days of the disease.

At least two guinea-pigs are scarified and intraperitoneally inoculated with the patient's blood. In some cases leptospira can be found in the peritoneal fluid as early as the third day after inoculation. If the guinea-pigs become infected, the temperature rises rapidly on about the ninth day and then falls. If the animal is now killed, the following post-mortem appearances will be noted. Slight to intense jaundice of conjunctiva, pads and skin, petechial hæmorrhages in the groin, butterfly hæmorrhages in the lungs and scattered hæmorrhages in the intestines.

Cultures of the blood from the seared heart will, on incubation, show growth of leptospira and, on examination of a saline suspension of triturated liver by dark-field illumination, the organism will generally be seen.

In certain cases after the animal has been inoculated with the patient's blood, no rise of temperature or jaundice is seen, but if some of the liver of this animal is injected into a second guinea-pig, this animal may develop typical symptoms with death and typical post-mortem appearances on the tenth day after inoculation.

(2) *From the Urine.*—The best chance of finding leptospira in the urine is between the fifteenth and twenty-third days of disease.

It is essential to give the patient an alkali by the mouth before the examination in order to make the urine slightly alkaline. Leptospira rapidly die in acid urine, and it is quite useless either to search with dark-ground illumination or to inoculate animals with the urine of the patient if it has been passed some time previously. The urine must be absolutely freshly passed and the reaction slightly alkaline.

The centrifuged deposit is searched, using dark-field illumination, and is also scarified into two young guinea-pigs.

It is advisable to warn the animal attendants that there is danger of infection when attending to these animals unless gloves are worn, especially if there are any abrasions or cuts on the hands.

#### SEROLOGICAL TESTS.

*Agglutination.*—Agglutinins appear in the blood of the patient about the sixth day and generally reach their maximum titre about the twentieth day of disease or a little later. A titre of 1 : 10,000 or 1 : 30,000 is frequently met with.

Agglutinins may persist for many years, even a titre of 1 : 300 several years after the onset of the disease is not uncommon (Fairley, 1934; Brown, 1935), and Postmus (1933) demonstrated their presence 6,066 days after the onset of the disease. This survival of agglutinins in the blood of a



patient must be taken into account when diagnosing the disease, for in a case recorded by McKeon and Brown (1936) the patient suffered from jaundice, epistaxis and dark-coloured urine, and his serum agglutinated the leptospira to a titre of 1 : 100. The serum in this case was examined on three separate occasions at approximately weekly intervals but no rise in titre of the agglutinins occurred. The differential blood-count in this case was typical of epidemic catarrhal jaundice and so, in spite of the fact that there were agglutinins in the blood to *Leptospira icterohæmorrhagiæ*, this case was diagnosed as being epidemic catarrhal jaundice, the presence of agglutinins being due to a previous attack of Weil's disease.

The agglutination test (Schüffner's technique) is performed with a culture of *L. icterohæmorrhagiæ* formolized to 0·2 per cent, using A.R. formalin.

The dilutions of the serum to be tested are most conveniently made with peptone water as the diluent in the depressions of a painter's palette (Winsor and Newton). A range of dilutions from a 1 : 5 to 1 : 15,000 is convenient : to these dilutions are added an equal volume of the formolized culture, the contents of each depression are then mixed and interaction is allowed to take place at room temperature overnight.

Before the antigen is used it is centrifuged to throw down any clumps of leptospira, the supernatant fluid being used for the test.

As well as having a negative control, with peptone water and culture only, a known positive serum is also put up, diluted in the same way as the patient's serum. The necessity for this is that formolized cultures, although sometimes they will last for six months or longer, may for some reason or other suddenly become inagglutinable.

The result is read by dark-field illumination using a 2/3-inch objective and a 10x ocular, droplets from the varying dilutions being placed on a slide and examined without a cover-glass. A definitely positive reaction at 1 : 10 is diagnostic in the presence of satisfactory controls.

Reference must be made to the occasional occurrence of a false agglutination. In these cases the aggregates which are seen under dark-field illumination are composed of small particles in which the leptospira are entangled. Sometimes this state of affairs may cause the greatest difficulty in reading the results, one thing that casts doubt upon this being a true agglutination is that the background is not cleared of leptospira.

If there is any doubt about whether it is a true agglutination, a portion of the mixture should be critically examined under a cover-slip with a 1/12-inch objective.

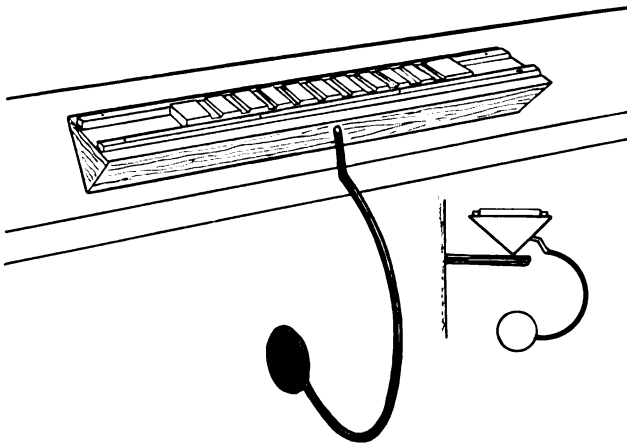
It is interesting to note that in certain cases in which this false agglutination has occurred there has also been a false Wassermann reaction lasting for a few days only.

In using the above agglutination technique it is usual to find that the reaction is more marked at a 1 : 30 dilution than at a 1 : 10, and in certain cases both the 1 : 10 and 1 : 30 are negative but the higher dilutions are positive.

## THE MACROSCOPIC TEST.

Pot (1936) describes a macroscopic agglutination test for Weil's disease and advocates the use of an antigen grown in Korthop's medium. Brown and Broom (1939) have drawn attention to the fact that human strains of *L. icterohæmorrhagiæ* isolated in England showed considerable differences in their agglutinability when using Schüffner's medium.

Brown (1939) described a rapid presumptive test for Weil's disease by means of which a result can be obtained within fifteen minutes of receiving the serum. This test is a modification of the technique used by Garrow (1917) and it is claimed that the results so far obtained are sufficiently accurate to warrant the administration of therapeutic serum to the patient ; in fact, in the case of the last five positive human sera tested by this method the results compare extremely favourably with those got either by Schüffner's method or the macroscopic technique. One noticeable feature is that in



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none of these cases has there been a negative zone in the 1:10 and 1:30 dilutions which have been present when using the other two methods. The test essentially consists in rocking to and fro on a slide for ten minutes small quantities of varying dilutions of the patient's serum in presence of a heavy suspension of *L. icterohæmorrhagiæ* ; this saline suspension is formalized to a concentration of 0.2 per cent. Ordinary cultures of leptospira are not sufficiently concentrated for this method and therefore a well-grown culture is formalized to 0.2 per cent and then saponin is added to it to a total concentration of 1:1,000. This is then centrifuged at high speed for half an hour and the deposit is suspended in 0.2 per cent formalized saline ; sufficient of this diluting fluid is added to make the opacity of the suspension equal to that of a No. 1 Wellcome opacity tube used for the standardization of vaccines. In order to obtain this state of concentration, a

well-grown culture has to be reduced to approximately one-tenth of its original bulk.

The dilutions of the serum are made in the depressions of a painter's palette as in Schüffner's method. They are then mixed with an equal quantity of the concentrated antigen and placed on the slide shown in the diagram. This is made to rock for ten minutes and the result is read by means of a hand lens against a black background.

*The Adhesion Test.*—Brown and Davis (1927) described a rapid test for the detection of antibodies in the serum of a patient suffering from Weil's disease. The test is a modification of the Rieckenberg reaction. It consists in allowing the following to interact at 37° C. for thirty minutes.

One volume of a fivefold dilution of the patient's serum. One volume of a young actively motile leptospira culture. One volume of a saline

THE ADHESION TEST.



Positive reaction.



Negative reaction.

suspension of *B. coli*. One volume of a five-fold dilution of fresh guinea-pigs' serum.

A small drop, covered with a coverslip, is examined by dark-field illumination with a 1/12-inch objective; in the case of a positive result the *B. coli* will be found to be firmly adherent to the leptospira. This adhesion test will be found to be positive to approximately the same titre as the agglutination test.

The appearance of a positive and negative adhesion test is shown in the above drawings.

*The Protection Test.*—Two pairs of guinea-pigs are inoculated intraperitoneally with 0.5 c.c. and 1.5 c.c. of the patient's serum respectively; one hour later the animals are inoculated with 0.2 c.c. of a young culture of virulent leptospira. If, with suitable controls with normal sera, the animals

receiving the patient's serum survive and those with normal sera die of the disease, the test is positive.

I wish to thank Dr. G. M. Findlay for his drawings of the adhesion test.

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## INFECTIVE HEPATITIS AND CATARRHAL JAUNDICE.

By G. M. FINDLAY, C.B.E., M.D., D.Sc.,  
*Wellcome Bureau of Scientific Research, London.*

IN the past hundred years there have been few wars in which jaundice has not been responsible for sickness. Blumer (1923) goes so far as to say that, with the possible exception of the War of Independence, jaundice has inevitably appeared in every campaign in which the American army has taken part. In the American Civil War six separate outbreaks were recorded, and in the Franco-Prussian, the Spanish-American, and the South African wars, jaundice in epidemic form was by no means uncommon.

The true character of all these outbreaks cannot now be determined since it was only in 1912 that Cockayne pointed out that there are at least two forms of infective jaundice, one characterized by high fever and considerable mortality, the other almost afebrile and relatively benign. The cause of the severe form was proved by Inada and Ido (1915) to be a leptospira and it is, therefore, known as leptospiral jaundice or spirochætosus icterohæmorrhagica, sometimes unfortunately as Weil's disease. During the World War of 1914-18 this infection occurred on the western front. The milder form of infective jaundice, for long known as epidemic catarrhal jaundice, comprises, it is now generally agreed, at least two separate conditions: (1) a true catarrhal and obstructive jaundice, and (2) infective hepatitis.

### CATARRHAL AND OBSTRUCTIVE JAUNDICE.

The view that epidemics of mild jaundice are due to a catarrhal condition of the mucous membrane of the duodenum with consequent swelling of the ostium of the common bile-duct can be traced back to Bamberger (1855). Pathological evidence in favour of this theory was brought forward by Virchow (1865), who at post-mortem had seen a case of jaundice in which the terminal portion of the common bile-duct was plugged by mucus. Since then a small number of cases have been recorded in which at death jaundice has been associated with obstruction of the common bile-duct. Eppinger (1908), for instance, reported the case of a girl aged 19 who fractured her skull and died as a result of jumping out of a window the day after admission into hospital for treatment of a typical attack of catarrhal jaundice, the jaundice being preceded for a few days by symptoms of gastro-intestinal catarrh. The liver showed no histological changes but the mucous membrane of the stomach and duodenum was swollen, and the papilla of Vater was unduly prominent, the mouth of the common bile-duct being completely blocked as a result of inflammatory swelling of its wall. More recently Hurst and Simpson (1934) and Barber and Osborn (1939) have recorded somewhat analogous findings. A number of cases of jaundice have also been described as a result of obstruction following inflammation of the lymph

nodes lying in close proximity to the bile-ducts (*cf.* Brulé, 1938). Much has been made of the association of jaundice with intestinal catarrh during the Gallipoli campaign, but in this instance the population was so saturated with bacillary dysentery and paratyphoid infections that the presence of intestinal catarrh is hardly surprising. Apart from this one outbreak, the ætiology of which can now never be determined, there is no record of a true catarrhal jaundice ever appearing in epidemic form. Sporadic cases of true catarrhal jaundice may, however, occasionally result from ascending cholangitis in association with a duodenitis or from inflammatory changes in structures such as the pancreas or lymph nodes, which lie in close relation to the bile-ducts.

Clinically there are no symptoms by which a true catarrhal jaundice can be differentiated from infective hepatic jaundice, or as it is more simply termed, infective hepatitis. Laboratory tests also fail to separate the two conditions, although Payne (1939) has suggested that in purely obstructive conditions the quantitative van den Bergh and the plasma phosphatase values rise and fall together, whereas in cases of infective hepatitis there is no such parallelism.

#### INFECTIVE HEPATITIS.

Proof that the mild form of infective jaundice is in reality a hepatitis, a view first promulgated by Stokes (1839), is obviously dependent, in the absence of definite clinical symptoms or conclusive laboratory tests, on pathological evidence alone. Despite the low mortality such evidence is by no means lacking. Martin (1918), for instance, in reporting on the pathological changes in certain fatal cases of jaundice occurring at Gallipoli, found necrosis of the parenchymatous cells of the liver and came to the conclusion that the jaundice was due to a hepatitis following a systemic infection rather than to a primary catarrh of the bile-ducts. In a small number of cases it has been possible to examine the condition of the liver within ten days of the onset of so-called "epidemic catarrhal jaundice." Thus Morgan and Brown (1927), during an extensive epidemic of jaundice occurring in the midland and eastern counties of England, observed one fatal case in a small girl whose death took place nine days after the onset of illness and eight days after the appearance of jaundice. The stomach and duodenum were normal, but the liver showed degenerative changes in the parenchymatous cells with round-celled infiltration in the portal spaces. Wallgren (1930) described two fatal cases in a large epidemic in Gotenburg in a 3-year-old girl and a 2½-year-old boy, both of whom died on the twenty-fourth day of illness. No changes were seen in the bile-ducts or duodenum, but again there was great degeneration of liver cells and round-celled infiltration in the portal spaces. Schrumph (1932) performed a biopsy on a woman eight days after the onset of so-called catarrhal jaundice. The duodenum and bile-ducts were normal, but the liver was necrosed. Similarly Hurst and Simpson (1934) found in a boy of 16, who died eight days after the onset of jaundice, no lesions in the stomach, duodenum or bile-ducts, but necrosis

of the parietal zones of the liver lobules with increased round-celled infiltration in Glisson's capsule.

Perhaps the two most striking cases, however, are those reported by Gaskell (1933) and, more recently, by Barber and Osborn (1939). Gaskell's case was that of a 5-year-old girl who died on the third day of illness from hæmorrhage after an operation for the removal of tonsils and adenoids four days previously. Twenty-four hours after the operation she had developed jaundice. At death the bile-duct system throughout was normal and not involved in any inflammatory process, but the liver itself showed acute hepatitis with much cloudy swelling and an inflammatory exudate at the periphery of the lobules. The girl came from a village where an epidemic of jaundice was occurring among the children. The case described by Barber and Osborn (1939) was that of a man aged 38, who felt unwell in the morning with nausea and flatulence. He thought he might walk it off, but on returning from a short walk he was quite exhausted and was left lying on a couch. About twenty minutes later he was found lying unconscious at the foot of some stone steps with his nose bleeding. On the third day of admission to hospital he vomited and the urine became dark in colour, while on the fourth day he was obviously jaundiced. He died on the tenth day after admission, the seventh day of the jaundice, the essential cause of death being hæmorrhage and fracture of the base of the skull. The stomach, intestines, and bile passages were healthy, but the liver showed clear evidence of a hepatitis affecting most severely the central zone and to a lesser degree the mid-zonal region of the lobule.

No definite line of demarcation can be drawn between these early cases of acute hepatitis and those dying at a somewhat later stage in which, as a result of efforts at regeneration on the part of the liver cells, the pathological process must be termed subacute necrosis. Such cases, dying two to three weeks after the initial illness and clearly associated with epidemics of, for the most part, mild jaundice, have been described in Great Britain by Okell (1931) and Findlay and Dunlop (1932), in the U.S.A. by Klemperer, Killian and Heyd (1926), and in France by Troisier, Albot and Netter (1938). In Sweden during the great jaundice epidemic of 1925-27, Bergstrand (1930) saw no less than ninety-seven cases of subacute liver necrosis. In the Lebanon, Yenikomshian and Dennis (1938) reported an outbreak of non-spirochætal jaundice in which there were seven cases of subacute necrosis; of the five female patients all were pregnant.

Sufficient evidence is thus available to show that the mild form of epidemic jaundice is in reality a hepatitis; there is no conclusive proof that a true catarrhal jaundice ever occurs in epidemic form and thus it would be advisable to abandon the use of the term "epidemic catarrhal jaundice."

#### THE ÆTIOLOGY OF INFECTIVE HEPATITIS.

Numerous unsuccessful attempts have been made to isolate specific bacteria or spirochætes from the blood, fæces, and urine, while efforts to

reproduce the disease in laboratory animals have also failed. Andersen (1937) and Andersen and Tulinius (1938) believe that they have transmitted the disease to pigs by feeding them with the duodenal contents of patients with infective hepatitis and by injections of blood. A form of porcine hepatitis is not uncommon in Denmark and it is suggested that outbreaks of infective hepatitis in man are due to eating the contaminated tissues of pigs. Up to the present no confirmation of these results has been obtained in this country, where hepatitis in pigs is a very rare disease. On occasions, however, it has been possible to cause a short febrile reaction in rhesus monkeys eleven to fourteen days after feeding them by stomach tube with blood taken from patients during the first seven days of illness. Further experiments are being undertaken to determine the specificity of this reaction in monkeys. The failure to cultivate any specific organism from cases of infective hepatitis suggested the possibility of a virus ætiology, especially after the accidental infection of a laboratory worker while working with sera from patients suffering from infective hepatitis (Findlay, Dunlop and Brown, 1931, cf. *also* Loeper 1937 and Cullinan 1939).

Further evidence in support of the virus ætiology of infective hepatitis came from a somewhat unexpected direction in the occurrence of jaundice after immunization against yellow fever both in this country (Findlay and MacCallum, 1937 and 1938), and in South America (Soper and Smith, 1938). For immunizing against yellow fever an attenuated pantropic virus is cultivated in a liquid medium consisting of one part of filtered human serum and nine parts of Tyrode solution with a small amount of minced chick embryo tissue. When first employed in 1935 no cases of hepatitis were noted, but early in 1936 reports began to be received of jaundice with symptoms similar to those of infective hepatitis. Of 96 patients with jaundice one died with lesions of subacute necrosis of the liver. Jaundice continued to occur despite various changes in the tissue culture medium. In November, 1937, another strain of attenuated tissue culture virus was employed and since then no cases of jaundice have been noted in more than 8,000 persons immunized. Since cases of jaundice were occurring for nearly two years in persons injected with different batches of vaccine, it was obvious that some hepatotoxic agent was being subcultured. The first explanation which naturally suggested itself was that the onset of jaundice, on an average two to three months after immunization against yellow fever, was caused by some modification of the particular strain of virus (17 EC) then employed. That the hepatitis was not directly due to the yellow fever virus was shown by the following facts :—

- (1) The symptoms differed entirely from those of yellow fever.
- (2) The virus of yellow fever could not be isolated from patients with post-inoculation jaundice at any stage of the disease.
- (3) The yellow-fever-immune body titre in patients with jaundice remained constant during and after the disease and showed no tendency to rise as it does after reinoculation with the yellow-fever virus.
- (4) Hepatitis occurred in persons who were injected with the yellow-fever



vaccine 17 EC but who were already immune to yellow fever as a result of either naturally acquired infection or previous immunization.

(5) Jaundice occurred in South America in persons injected with the yellow-fever vaccine who did not become immune to yellow fever owing to a defect in the vaccine.

Since the agent responsible for the jaundice was not the yellow-fever virus but was being carried over in the tissue cultures with the yellow-fever virus, steps were taken to explore other possibilities (cf. Findlay, MacCallum and Murgatroyd, 1939). By a process of elimination the only possible source of the agent appeared to be the pooled and filtered human serum which had been employed in the tissue cultures from 1935 to October 1, 1937. By this latter date, instead of using pooled sera obtained from donors whose past and future medical history could not be accurately obtained, a panel of donors had been built up, consisting chiefly of medical students and laboratory technicians. All these donors could state definitely that they had never suffered from jaundice. In addition the serum obtained from each individual was not used in the culture medium for at least thirty days after it had been withdrawn, and only when evidence was forthcoming that the donor had remained in perfect health since the withdrawal of blood. This precaution did not immediately stop the occurrence of hepatitis, for from October 1 to November 11, 1937, there were ten cases of jaundice among 291 persons immunized. Nevertheless when combined with the use of a new strain (17 D) of yellow-fever virus from November 11, 1937, it has been sufficient to prevent the occurrence of any further cases of jaundice among the eight thousand persons since immunized against yellow fever.

The evidence derived from these observations may be summarized as follows :—

(1) An agent causing symptoms and lesions in man indistinguishable from those found in infective hepatitis was capable of being propagated in a serum-Tyrode medium containing chick embryo tissue, the serum being either of human or monkey origin.

(2) The agent produced no visible growth when cultivated aerobically and anaerobically on a number of different bacteriological media.

(3) The agent was not visible with the highest powers of the ordinary microscope.

(4) The agent was freely filtrable through Seitz EK filters.

(5) The agent withstood freezing and drying for many months when kept at 4° C.

An agent having the above characteristics would normally be classified as a filtrable virus.

Nevertheless proof was lacking that cases of post-inoculation jaundice could give rise to ordinary infective hepatitis in contacts. Evidence on this point came from a different source. Propert (1938) reported that seven children housed in one block of a large institution for mental defectives were injected with pooled convalescent measles serum to protect them from measles, with which disease they had recently been in contact.

Each child received 4·5 c.c. of the same pooled serum which had been filtered, phenolized, and tested for bacteriological sterility. After an interval of between seventy-eight and eighty-three days all these seven children developed jaundice and three of them died with lesions typical of acute necrosis of the liver. No bacteria or leptospira were isolated. No other children in the institution developed jaundice at this time, but just two months later two other children who had been contacts with the first seven jaundice patients, but had themselves not been inoculated with the pooled serum, developed jaundice. Their illness was indistinguishable from that of infective hepatitis; no other children in the institution, with the exception of these contacts, developed jaundice. According to MacNalty (1938) between 82 and 109 persons were inoculated in various parts of the country with this same pool of measles-immune serum: 37 developed jaundice and seven died with acute liver necrosis. No leptospira nor specific bacteria were isolated. More recently jaundice has followed the injection of another bacteriologically sterile batch of pooled measles-immune serum.

Since therefore pooled human serum may contain a filtrable agent capable of causing in man a syndrome clinically and pathologically indistinguishable from that of common infective hepatitis, it seems highly probable that the cause of infective hepatitis is an agent possessing the characteristics of a filtrable virus.

One moral to be drawn from these observations is that human serum should not be used for purposes of immunization till at least one month after its withdrawal, the donor having remained in good health for this period.

#### THE CONTROL OF INFECTIVE HEPATITIS.

Infective hepatitis is a widely distributed disease by no means uncommon in Western Europe and America, as well as in West Africa and the near East; comparatively few records of its occurrence have come from India. It is most commonly seen in partially closed communities such as schools, barracks, and hospital wards. In country districts in Great Britain the village school not infrequently acts as the focus of infection, the disease dragging on through neighbouring villages for months or even years at a time. Special interest attaches to the frequency with which the disease appears in out-patient departments. Outbreaks have been recorded in a diabetic clinic (Graham, 1938), in patients treated with acriflavine for gonorrhœa (Murray, 1930) and in numerous treatment centres for venereal disease among patients receiving injections of the arsphenamines or bismuth. The fact that such outbreaks have often involved attendants and others who were not receiving antisyphilitic treatment is evidence that the drugs were not the primary cause of the jaundice, although the administration of hepatotoxic medicaments may naturally predispose to liver damage.

Infective hepatitis is most frequently seen in children and young adults, though older persons are by no means exempt; when such older persons are attacked the symptoms may be of long duration and considerable severity.

The view that jaundice is a contagious disease is of long standing, for Zacharias who was Pope from A.D. 741-752, in writing to Boniface, who was canonized for his efforts to convert the Germans to Christianity, strongly recommended that patients with jaundice should be segregated lest others catch the contagion (Migne, 1844). Infection is spread not by food or water, but rather by direct contact, probably as a result of droplet infection. In some outbreaks nasal catarrh is a common occurrence. It is not uncommon to see one member of a family after another succumb to infection. Epidemics have been successfully brought to an end by preventing overcrowding in hospital out-patient departments, but in view of the recent isolation of poliomyelitis virus from the stools the possibility of faecal contamination in infective hepatitis cannot be entirely excluded.

There is now general agreement that the incubation period is in the neighbourhood of four weeks, with a possibility in some instances of an even greater extension. This long incubation is suggestive of a virus infection for there are a number of virus diseases with incubation periods of many months. The period of infectivity is probably short although patients on the fifth and seventh days of illness have proved infectious (Pickles, 1939). It must also be remembered that patients are infective during the pre-icteric period which may last from one to at least ten days, while in any large epidemic there are always some individuals in whom jaundice is never noted clinically, although the urine may be dark in colour for a day or two. The possibility that carriers exist cannot be entirely ruled out (Newman, 1939). A quarantine period of fourteen days is sufficient to prevent spread of infection.

The diagnosis of infective hepatitis, when it occurs in temperate climates and in mild form, is not difficult despite the absence of any definite laboratory test. The absence both of high fever and of a polymorphonuclear leucocytosis serves to differentiate the disease clinically from leptospiral jaundice. Failure to isolate leptospira, to infect guinea-pigs, or to detect agglutinins against leptospira gives definite laboratory proof. The total and differential blood-count usually shows a slight leucopenia with a relative decrease in the number of polymorphonuclear leucocytes and in some cases an increase in the large mononuclears (cf. Findlay, Dunlop and Brown, 1931). The mononuclear increase is never as great as in glandular fever but as cases of glandular fever associated with jaundice have recently been described by de Vries (1938) the sheep cell agglutination test of Paul and Bunnell should be carried out in any doubtful case.

In France another condition has not infrequently been termed catarrhal jaundice. In this syndrome, which appears to be of an allergic nature, the jaundice is associated with rheumatic pains, skin rashes, and very frequently severe migraine (cf. Caroli, 1938).

Owing to the fact that symptoms of liver insufficiency may occur suddenly after very mild prodromal symptoms, all cases of infective hepatitis should be given glucose by the mouth. If there are signs pointing to acute liver insufficiency, isotonic (5 per cent) glucose should be at once given intravenously, not more than 500 c.c. being injected in the twenty-four hours.

The administration of 5 to 10 units of insulin in the same period frequently aids in the assimilation of the glucose.

#### CONCLUSIONS.

Evidence is brought forward to show that so-called epidemic catarrhal jaundice is in reality an infective hepatitis.

There is reason to believe that infective hepatitis is due to a filtrable virus.

The control of infective hepatitis is discussed.

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## THE PROBLEM OF SICK WASTAGE IN WAR.

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THE avoidance of sick wastage in war is a major problem, for the numbers involved throughout the history of military medicine show a marked preponderance over the numbers of wounded.

### THESIS.

The solution of the problem of sick wastage depends primarily upon the determination of causes and the ability to avoid them. This depends largely upon the well-ordered contact of two sources of information : that derived from sources near to the time and *locus* of causation, and that derived from the study of sickness under hospital conditions.

#### (1) *Relation to Military Conditions.*

As far as the causes themselves arise from military conditions which cannot (in whole or in part) be avoided, so far is the capacity to remove the causes limited in execution.

And from this it follows that only with knowledge of relevant military conditions can the problem reach a profitable measure of solution.

#### (2) *Two Methods of Approach to the Problem.*

There are two methods of approach to the problem. And one is the approach of prophylaxis as derived from the twofold knowledge consisting of prevalent causes common to past wars of the one part, and of the general and special methods of their avoidance of the other part.

The second is by the examination of the incidence of morbid states as they arise and by attempts to estimate the relative importance of possible existing factors in their causation.

The methods of prophylaxis are general and special. The general include such methods of hygiene as the protection of food and water from contamination, suitable rations and dress, provision of bathing and clean clothing, the instruction of officers in the care of their men, and the elimination of the unfit.

The special include the known means of immunization against infection.

Both these methods are in use. They are based upon past military experience. They may be added to in the light of special needs arising out of experience of the present war.

In attempting to estimate the relative importance of possible factors in the causation of sick wastage, it is first necessary to be aware of the time and *locus* of the incidence.

For this purpose some form of classification of sickness in terms of causation must be provided.

Now in war the multiplication of paper is to be avoided like the plague (that is always unless an almost certain good justifies the risk), and the further forward are the duties of a medical officer, the less justified is his involvement in *paperasserie*.

It becomes then a postulant that a plan to investigate the causation of sick wastage is effective in inverse proportion to the amount of "paper work" thrown upon the first stage in the registration of sick casualties, namely, the unit medical officer.

For an effective classification applicable at once to the opportunities and limitations of the unit medical officer on the one hand and to the refinements of the specialist on the other, two qualities are necessary. One is that the broad simple categories devised as applicable to information furnished by the unit medical officer shall be true categories of causation.

And the other is that these broad categories shall be capable of useful sub-categorization with the aid of specialist knowledge after the first general view has divided the field of study into particular sectors.

Now the factors of causation are many, and the making of categories is only useful if the categories bear a useful relation to causation in terms of the means of their abatement.

The primary categories, then, should be few, simple, and capable of direction to time and *locus*, and should be eliminative of those categories of causation which are outside the essential medical and epidemiological problems upon which specialist advice can be usefully sought.

And for this purpose the following *schema* is proposed.

#### *Schema.*

*The Unit Medical Officer.*—The Unit Medical Officer (the first stage in the registration of sick casualties) is asked to bear in mind five categories, to make out his nominal roll of sick sent to a Field Ambulance in duplicate in his A.B.153, to retain the duplicate in this book and, after the diagnosis in each case, to enter the appropriate capital letter according to the following plan :—

O for "*old*"—those cases in which the cause was presumably present when the soldier was enlisted, e.g. hernia, hydrocele, varix, old injuries, deformities, defective teeth, sight, hearing.

R. for "*recent*"—all cases of sickness (except those in categories S, T, and V) which have presumably occurred during service in the field. This category will include not only such as tend to become prevalent on active service (such as diarrhœa, cerebrospinal meningitis, nephritis, trench-foot, epidemic jaundice, the enteric group, rheumatism, pyrexias of known or unknown origin), but also all the infectious and other diseases common to civil and military life not included in the other categories.

S for "*skins*."—This group is responsible for a high sick wastage in war. It is important for two reasons. First, because extensive and obstinate secondary infections commonly develop either in the form of a furunculosis following pruritic states (such as scabies or pediculosis), or of an extensive impetiginization of seborrhœa, or dermatitis or of allergic, toxic, or mycotic primary lesions. And, secondly, because observation of the incidence of sick wastage under "S" may show a topical and temporal parallelism with an undetermined "P.U.O." which may reveal the pathogeny of the latter (as in the trench fever of the last war).

T for "*trauma*," is the group of recent accidental injuries. Its importance is mainly negative or eliminative, thus rendering the study of the other groups more informative. This group calls for vigilance in the detection of self-inflicted wounds. And it may arouse investigation leading to the protection of soldiers from some particular common accident.

V for "*venereal*."—This group must be considered separately. The mechanical factor in causation is a "constant." The source of infection is commonly at a distance from the *locus* of its apparent incidence, and standing orders for the tracing and segregation of sources of infection on the one hand, and of therapeutic and disciplinary measures of disposal on the other hand, are a familiar part of active service routine.

Two other points are relevant to causation. One is that "V.D." may be intentionally employed as a substitute for "S.I.W."

The other is that the prevalence of infection in particular base areas may point to boredom or other causes of impaired *morale* in certain reinforcement camps, and this may call for better administration as well as for the provision of adequate counter-attractions for the soldier's leisure.

### *The Stages of Information.*

*The Unit Medical Officer.*—Now it is submitted that in the first place this system of categories is sufficiently simple to be applicable to the unit medical officer at all times except when his unit is actively engaged. The number of categories is but that of the fingers of one hand. The groups are readily comprehended and easily remembered. The designating letter is the initial of the explanatory word. These letters cannot be confused with the only other letters with which he has to deal, namely "attend A, B, C: D for detained: H for hospital." The letter "P" is omitted but it may be employed, if need be, should a prevalent "pyrexia" appear in the "R" group and call for special investigation and returns. Letters Q and U are avoided as liable to confusion with O and V.

If doubt occurs as to which category should embrace certain cases, the

question should be asked, "What is the probable cause and where and when did it arise?" Thus, although tabes and tuberculosis may be said to have a pre-enlistment origin, in so far as any evidence was presumably lacking on enlistment, they should be grouped under R. Or again, should an "I.A.T." be grouped under R, S, or T? If it be an infection of a recent accidental wound, then under T; if a secondary infection of a primary skin lesion, then under S (such as impetiginized seborrhœa, or furunculosis complicating scabies); if apparently of neither (such as erysipelas, carbuncle or whitlow), then under R.

#### *The Field Ambulance Stage.*

On arrival at the field ambulance, the entries from the accompanying sick nominal rolls will be transferred to the "A & D Book," and the additional labour for a clerk to enter the appropriate capital letter after the diagnosis is negligible. The entries having been made, the nominal rolls received with the unit sick for the day, will be fastened together and sent next day to the A.D.M.S. of the division, docketed "Sick sent to — F. Amb. Date."

#### *Divisional Headquarters State.*

As the result of these actions, about 25 to 30 daily sick rolls will reach the A.D.M.S. A clerk would be employed about two hours a day in adding up the figures under O, R, S, T, V, and entering this under columns headed "Unit : O : R : S : T : V : total." This last will be made out in duplicate, one copy for retention the other for D.D.M.S. Corps. This may be known as the *Divisional Daily Sick Summary* and will represent the sick wastage of the previous day.

The retained copy fastened to the sheaf of sick rolls will be laid before the D.A.D.M.S., who will scrutinize items wherever a high number under O, R, S, T, or V attracts attention. This scrutiny will occupy from half an hour to an hour according to the importance of the information, and the D.A.D.M.S. will produce any necessary graphs or diagrams and bring anything of importance to the attention of the A.D.M.S.

The latter will then be in a position to order his D.A.D.M.S. to make any necessary visits to units with a view to eliciting pertinent information and to furnishing himself with the necessary material for replying to enquiries from higher authority.

#### *Corps Headquarters Stage.*

The Divisional Daily Sick Summary (together with daily sick rolls from units of Corps troops) will be received by the D.D.M.S. The Corps Daily Sick Summary will be made out two days in arrear, incorporating the Corps Troops Daily Sick Summary with the Divisional Summary of the second day prior. At this stage of time and *locus*, there is less urgency for detailed investigation than exists in Divisional areas. Corps sick summaries could be compiled and rendered as weekly summaries to Army Headquarters one week in arrear.



*Army Headquarters Stage.*

At this stage the total numbers furnished by sick-wastage returns, the total "population" from which these figures are derived, and the number and diversity of military conditions and topographical variants represented by divisional areas, constitute bases for useful comparisons.

At this stage (Army Headquarters) moreover, there is available another source of information: that derived from "treatment centres" in the Army area; the C.C.S.s, and the small advanced general hospitals, enriched and interpreted with the aid of the consulting physicians and surgeons, bacteriologists and other specialists attached to the Army.

Thus two systems of information bearing upon the problems of sick wastage each converge in the Army area, *but each has a separate point of convergence.*

The next step is to make contact between these two separate points of convergence.

*Army Headquarters the Locus of Approach Between Two Separate Systems for the Study of Sick Wastage.*

Reference to that masterly epitome of sick wastage in the last war, "A Note on Sick Wastage," by Colonel A. B. Soltau, C.M.G., C.B.E., T.D. (JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, Vol. xxv, pp. 152-159) reveals the valuable deductions made from an analysis of sick admissions for one year to certain C.C.S.s in France and the system of categories employed by Colonel Soltau in his investigation of the problem.

Why then adopt an apparently totally different set of categories as suggested in this argument?

The answer to this question involves four primary factors and may be answered as follows:—

(a) *Retrospect and Prospect.*—The categories of Colonel Soltau are in the light of knowledge arrived at in large measure in retrospect.

(b) *Special Conditions.*—The information is derived from "hospitals" in which the factor of lapse of time and special opportunities afford means for observation, diagnosis, and study, not available in forward areas.

(c) *Time Factor.*—Whilst the information is invaluable in the study of this problem, the lapse of time involved in its collection leaves a serious gap from a military point of view in measures for the abatement of causes and the rapid checking of sick wastage at its origin.

(d) *Dislocation in Time and Locus.*—The investigation of causes (if this were the only method available) leaves so long an interval between the time and locus of causation on the one hand, and the investigation on the other, that the original conditions will have entirely changed and can no longer be checked.

*The Appointment of a Co-ordinator.*

It is submitted that a co-ordinating medical officer would exercise an important function in attacking the problems of sick wastage.

*Functions.*—Whilst attached to G.H.Q. (e.g. as A.D.M.S. (sick wastage) G.H.Q.) his *locus* of function would be mainly Army Headquarters which he would visit in turn or as special problems arose for investigation.

He would, when advisable, visit Corps and Divisional Headquarters where particular problems of sick wastage were localized and, in divisional areas, make himself acquainted with forward conditions whenever visits thereto appeared desirable.

His essential function should be so to acquaint himself with the forward conditions associated with the causes of sick wastage as to be able to answer questions at the various conferences called from time to time by Ds.M.S. of Armies, at which consulting physicians and surgeons and other specialists are present to give their advice, and to make the experiences of one or another Army available to all. Further, in the light of his information gleaned over a wider area, he would be of service to conferences of D.Ds.M.S. and A.Ds.M.S. (who have many problems to consider beside those of sick wastage), as such conferences might be convened from time to time by the Ds.M.S. of Armies.

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## ON THE MANIPULATION OF JOINTS.

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IN a previous article (JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, February, 1938), the indications for the use of manipulative surgery were discussed. The treatment of dislocations is dealt with in standard surgical textbooks and is not being considered in this article.

In manipulating a joint the object to be attained is the restoration of function. Treatment does not end with the freeing of the joint but necessarily includes after-treatment such as massage and remedial exercises. The gaining of the patient's confidence in the restoration of neuromuscular control is essential.

Some of the great bone-setters of the past have stated as regards their technique that "the twist is the thing." This can be interpreted to mean that the particular manoeuvre is carried out suddenly and catches the controlling muscles off their guard. A sudden movement is more likely to rupture an adhesion, but at times stretching by a series of movements is the best that can be attained. The latter is necessary where there is the possibility of infection so as to guard against reaction.

Range of movement in individual joints will be discussed more fully when considering them regionally as well as special notes as to grip.

Generally speaking, for the spine and lower limb the patient should be recumbent; for the arm or foot where anæsthesia is not used, he may either lie or sit. The operator's stance or seat will be on the affected side or at the foot of the couch to allow of the easiest control of the affected part. Ambidexterity is necessary for satisfactory manipulation. A suitable couch or operating table of strong construction and sufficiently padded is required; a stool is also of use for the operator to stand on for some manipulations.

*The Spinal Column.*—In dealing with the cervical region the patient should be on his back with the shoulders well up to the end of the couch. The patient's head is gripped by a hand on each side; thumbs forward and fingers towards the nape of the neck.

In addition to purely spinal movements there is very free flexion and extension of the occiput on the atlas.

There are two types of movement in the cervical spine: (a) Where the head is carried in the horizontal plane; (b) a much freer action where the head moves with the spine in extension and flexion. A similar range of movement occurs also in the lumbar spine.

In the cervical spine flexion should bring the chin to the upper end of

the sternum, a movement familiar in testing for meningitis. Extension is to about  $45^{\circ}$ . Side flexion is attainable to about  $65^{\circ}$  and rotation about  $75^{\circ}$ .

The dorsal spine is much less mobile than the cervical. In the upper part movements are chiefly flexion and extension, whereas in the lower part they tend to merge into that of the lumbar region.

In considering the dorsal region, the costo-vertebral joints must not be forgotten, and in the whole spinal area lesions of the muscles play an important part.

Rotation is obtainable in either the sitting or the prone position. For the former the patient sits on a stool of suitable height and the operator standing behind, grips a shoulder with each hand and forcibly rotates the body, a manœuvre involving chiefly the lumbar region.

Extension can be obtained by supporting the lower dorsal region with one hand whilst the other presses the upper chest back. Where the lumbar region is also involved, if the feet are supported by the operator or a heavy piece of furniture, extension is obtained by allowing the head to fall back towards the floor. Flexion is obtainable by the reverse movements. Lateral flexion can be obtained passively by passing one arm under the axilla of the patient from behind and round in front to the waist when the patient can be lifted or forced to one side.

In the lateral position on the couch rotation is obtained by pulling the shoulder back and pressing the pelvis in the opposite direction with the other hand.

Flexion can be obtained by passing one arm behind the thigh and lifting them up towards the chin. The operator will require a stool to stand on and when the patient is heavy, additional force is obtainable by grasping both hands.

Extension is obtained with the patient in the prone position when the thighs are lifted up off the couch.

For a much fuller consideration of the problems of backache, the best textbook is Mennell's "Backache," where the subject is gone into much more fully than can be done in this article.

*The Upper Limb.*—The clavicular joints seldom require manipulation apart from dislocations.

The shoulder joint more often develops adhesions outside rather than inside the joint as a result of trauma or disease. The movements are :—

**Flexion :** A forward movement through an angle of  $90^{\circ}$  at the joint itself. A further  $90^{\circ}$  is obtained by movement of the scapula.

**Extension** is a backward movement through  $45^{\circ}$ , the latter part of which is aided by the scapula moving.

**Abduction** is the raising of the arm away from the body and has a range of  $90^{\circ}$ . The arm can be raised through another  $90^{\circ}$  to the vertical by moving the scapula.

**Rotation** occurs between the humerus and glenoid cavity in the long axis of the humerus through a range of  $90^{\circ}$ .

Circumduction is a combination of these various movements.

In so far as the scapula is movable over the chest wall, this mobility has constantly to be borne in mind in relation to the scapulo-humeral joint. Either or both sets of movements may be limited, and when manipulation is done on the shoulder joint proper, fixation of the scapula is necessary.

For moving the shoulder joint either a long or a short grip may be used.

In the long grip, the forearm is grasped just below the elbow which is flexed to a right angle, the shoulder blade being fixed by the operator's other hand or an assistant, the various movements at the joint are gone through.

In the short grip, with the patient lying down, the operator's hand grips the arm about halfway up with the elbow resting on his forearm. This grip gives a better hold as regards abduction.

*The Elbow-joint.*—This is a composite joint including a Ling action of the ulna on the humerus through a range of  $135^{\circ}$  and a rotatory movement of the radius on the ulna of  $180^{\circ}$  at their upper joint.

For flexion, the lower arm is gripped by one hand whilst the other grasps the wrist and forces the hand towards the shoulder.

For obtaining extension one hand is passed round the inner side of the arm to grasp the lower end of the humerus from behind. The other hand then presses the front of the supinated forearm above the wrist into the extended position. This latter manœuvre can be assisted between treatments by the patient carrying a weight.

In dealing with the radio-ulnar joints the elbow is grasped by one hand whilst the radius is rotated by a handshake grip.

"Pulled elbow" in children is a subluxation of the upper radio-ulnar joint. It can be reduced by using the last-named grip, rotation of the radius being combined with a thrust of the radius towards the humerus with the elbow flexed to a right angle. In an early case this can be done easily without pain or anæsthesia.

Tennis elbow may be due to one of several underlying pathological causes such as an inflamed bursa under the extensors of the wrist or adhesions resulting from ruptured muscle fibres. Manipulation will consist of rotation of the radius with the wrist in the flexed position with accompanying pressure of the thumb over the tender spot; varying degrees of extension or flexion of the elbow may be necessary in different cases. Careful after-treatment by massage and movements is necessary.

*The Wrist-joint and Hand.*—The normal movements are flexion through  $90^{\circ}$ , extension  $65^{\circ}$ , adduction  $60^{\circ}$ , abduction  $45^{\circ}$ . In addition there is circumduction. Movement of the lower end of the radius on the ulna exists in a range of  $180^{\circ}$  in pronation and supination. There is a certain amount of mobility in the carpus and metacarpo-carpal joints in addition to those which take place mainly at the carpo-radial joint.

The wrist, like the shoulder and ankle, is very liable to stiffness resulting from peritendinous adhesions resulting from Colles' fracture and traumatic

or septic tenosynovitis. Fracture of the scaphoid has also to be considered. The freeing of these adhesions may require faradization to free them in their line of pull.

In manipulating, the hand is grasped in the hand-shake position whilst the lower end of the forearm is steadied by the other. The wrist is then put through its various movements.

Where the tendons are bound down, manipulation will free them in the direction of their relaxation. Taking the flexors first the fingers are extended and the whole hand is bent back on the forearm. For the extensors the fingers are doubled up and the wrist is forcibly flexed.

The metacarpo-phalangeal and second interphalangeal joints flex to a right angle, whilst the first has an additional  $45^\circ$  of flexion. The first-mentioned has also adduction and abduction through a small range and circumduction.

In the thumb metacarpo-phalangeal and interphalangeal joints have flexion only of  $90^\circ$ . The metacarpo-carpal joint has as movements adduction, abduction, extension, and opposition. The metacarpo-phalangeal joint is liable to subluxation as a result of injury to the lateral ligaments, a condition known as boxer's thumb (*British Medical Journal*, 1930). This requires efficient reduction and splinting in the correct position as early as possible if permanent disability is to be avoided.

In manipulating the digits, traction in the long axis is a desirable preliminary. In dealing with these joints as with others, efficient control of the proximal bone is essential, particularly if the bones have lost their density.

It should always be borne in mind that much stiffness of the hand occurs secondarily to fractures about the wrist and to sepsis; efficient treatment of these conditions should therefore reduce the number of cases requiring manipulation to restore function.

*The Hip-joint.*—This is a ball-and-socket joint of strong construction. Its movements consist of flexion  $150^\circ$ , extension  $45^\circ$ , adduction and abduction each of  $45^\circ$ . Circumduction is a combination of these. External rotation is possible through about  $60^\circ$ , internally through  $30^\circ$ .

In manipulating the joint the patient lies on his back, and when under anæsthesia the pelvis requires fixation by an assistant or strap. Alternatively the sound thigh may be held up in extreme flexion or down on the couch, when the contrary manipulation is being performed on the affected side.

A long or short grip may be used comparable to that described for the shoulder, the latter being used mainly for abduction.

For rotatory movements the hip and knee are partially flexed, and one hand grips the knee whilst the other produces the rotation by a hold at the ankle.

*The Knee-joint.*—Extension in this joint consists of the tibia and femur being in line, flexion takes place until an angle of  $45^\circ$  occurs between these bones, movements are limited at their extremes by the crucial ligaments.

There is also rotation of the tibia on the femur which is associated with the "screw-home" in extension. In addition, when the joint is partially flexed a movement of the tibia at right angles to the long axis of the femur is obtained. The patella can also be moved laterally in addition to the usual voluntary one in extension and flexion, a point to be remembered in manipulative measures as its lateral movements may have to be freed first.

In manipulating, either short or long leverage may be employed. In short leverage the leg is grasped about its centre and the knee is forcibly flexed.

Long leverage is the more generally useful. One hand grasps the foot, palm of the hand under the heel, thumb on the outer side, fingers over the inner malleolus. The other hand supports the knee. With this grip all the movements necessary can be obtained including a slight degree of lateral mobility. Pressure from the controlling hand can be exerted where required, as over thickened synovial membrane or infra-patellar pads.

For obtaining the antero-posterior movements of the tibia on the femur, the hip and knee are flexed and the foot rests on the couch. The latter is steadied by the operator's buttock in the semi-sitting position on the couch and the hands grasp the tibia below the knee.

Manipulation is used in dealing with semilunar cartilage, and in many early cases reduction can be effected. As the cartilage, at best, is long in healing, subsequent operative removal is the more certain permanent cure. The manoeuvre consists in the rotation of the tibia with the knee flexed to a right angle, abduction being maintained at the same time. This is followed by a quick extension accompanied by internal rotation. Where reduction is complete an audible snap is often heard and the patient should be able to extend the knee freely without pain. The after-treatment consists of early movement and massage, the avoidance of rotation which is aided by raising the inner border of the sole and heel, and elastic pressure.

Fuller details of internal derangements of this joint are well dealt with by Timbrell Fisher.

*The Ankle and Foot.*—There are roughly three zones of movement in this region, the ankle-joint proper (astragalo-tibial), mid-tarsal, and toes.

The ankle-joint has only dorsi- and plantar flexion through a range of about 90°.

At the mid-tarsal joint occur inversion, eversion rotation, and a certain degree of plantiflexion which is brought about by the short flexors of the foot and produces an approximation of the metatarsal heads and os calcis. Associated with these there is mobility of the metatarso-tarsal joints most marked in the 1st and 5th. Inversion and rotation bring the sole of the foot to look almost mesially, and is seen best in small children where it is under voluntary control. In adults wearing footwear much of this mobility is lost with secondary wasting of the short muscles, particularly in women wearing high heels.

The toes are similar in their movements to the fingers, but the range in

boot-wearing individuals is less than in those not using footgear and is not so free.

Tendinous adhesions have already been referred to.

As regards what is called by many "flat foot" and by orthopædists more frequently as foot strain, there is a relative dropping of the antero-posterior arch associated with pain after use and decreased mobility. On mobilizing the region, adhesions in the flexor brevis origin area are found. If these are broken down and exercises instituted to the tibialis posticus and short flexors the condition should be cured. The insides of the soles should also be wedged up to take the strain off the calf muscles.

In manipulating the region one hand grasps the heel whilst the other holds the fore-foot and puts the foot through its various movements.

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## Editorial.

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### GAS GANGRENE.

AT the outbreak of the Great War, 1914-18, gas gangrene was known as a somewhat rare complication of civilian surgical wounds, with an uncertain ætiology. The experiences of the South African War did not lead military surgeons to foresee the possibility of a large number of cases. In the early fighting around Mons and in the subsequent retreat there were not many cases, probably on account of the fine weather, open warfare, and the fact that many of the severely wounded were not evacuated. It was not regarded as a serious complication until the advance to the Marne and the fighting on the Aisne allowed of a greater proportion of wounded being observed. At this time there were more cases than at any subsequent period, and competent surgeons estimated that gas gangrene occurred in 10 to 12 per cent of the wounded. This was probably due to the number of wounded, slow evacuation, and want of knowledge of the danger of the condition, and the absence of surgical prophylaxis. In the middle of September, 1914, the Army Medical Service realized the importance of the condition and Professor Weinberg, of the Pasteur Institute, was asked to see some of the cases, and this led to his important work on pathogenic anaerobes.

Early in October the Army moved to Flanders, and immediately Sir Anthony Bowlby and Sydney Rowland investigated the condition. They eliminated the possibility of the disease being a hospital infection and it became important to ascertain and eliminate the predisposing causes.

The local condition of the soil appears to influence the incidence. In the South African War there was a hot dry climate and a sandy soil, and the disease was rare. On the Italian Front and on Gallipoli the disease was far less frequent than on the Western Front where the fighting was mainly on highly cultivated and fertile land.

Cases are more common in wet cold weather and it is the infiltration of the clothing that is of importance in this connexion.

The condition of the man when he receives his wound is of moment. Exhausted men are more likely to suffer from gas gangrene than troops who are fresh and well fed.

Deep wounds with much destruction of tissue and little or no opportunity for drainage are those most likely for gas gangrene to set in. Wounds in which the blood supply is interfered with in any way are favourable for the development of anaerobic bacteria. It is certain that the cutting off of the blood supply to a muscle is an important factor. Campbell and Pennefeather showed that some muscles, such as the gracilis, are dependent on a single main artery for their nourishment; others, especially the segmental muscles, have two or more arterial supplies. Their observations showed that the circulation within a muscle is largely a terminal one and that while the capillaries anastomose, the larger trunks do not. In the case

of muscle with a single blood supply severance or thrombosis of the artery will render the muscle bloodless, but in the case of a muscle with several blood supplies the severance of an artery will not kill the entire muscle, but only its particular distribution. These facts explain how a dead or gangrenous muscle may be found in the midst of a healthy group and the arrest of disease at one point in a muscle. The subsequent death of a muscle apparently healthy at an operation may be due to the surgeon inadvertently interfering with the blood supply.

Gas gangrene can be most conveniently described under two heads :

(a) Group gangrene, and (b) segmented gangrene (massive).

In group gangrene there may be a wounded muscle or muscle group from which the blood supply has been cut off, or infection of a muscle or group of muscles with an intact blood supply. In the first case a certain muscle or muscle group is dead but otherwise little altered except where wounded. Next to the dead muscle lies perfectly normal contractile muscle. The disease is, so to speak, a longitudinal one ; infection finds difficulty in passing from one muscle to another, but easily extends up and down from end to end. The first change is in the appearance in the muscle involved : it has a salmon-red colour. This has been called the stage of "red death." About this time gas bubbles become evident to the eye and can be pressed up and down in the muscle tissue. The substance of the muscle becomes friable ; the colour changes to yellow and possibly in the end the muscle becomes black and diffuent. The connective tissue near the muscle may be little altered ; at other times it is filled with white or blood-stained œdema. Gas may or may not be present in the areolar tissue, and when present tends to find its way along the main vessels of the limb.

Infection of a wounded muscle or muscles with an intact blood supply is a comparatively rare phenomenon, living muscle shows a great resistance to invasion. When actual infection takes place the surface of the wound is dry or dirty looking, or in some cases black. Next to this is a red area which is limited towards the sound tissue by a yellow sinuous line. This line is raised and hard to the touch ; next to it lies normal contractile muscle.

In segmental or massive gangrene all or nearly all the muscles of a segment of a limb distal to a complete arterial lesion, deprived of their blood supply, die and become infected.

Four organisms are mainly responsible for the disease : (1) *Bacillus welchii* (or *Clostridium welchii*).—This bacillus causes yellow œdema, large gas production of short duration, a salmon-red colour of the muscles, soft pulpy muscles, slight sourish smell, bronzing of the skin, appearance of fat globules in the discharge. (2) *Vibrio septique* (or *Clostridium œdematis maligni*).—This vibrio produces blood-stained œdema, large gas production, deep red colour of the affected muscle, an odour which is not putrid but rather rancid in character. (3) *Bacillus œdematians* (or *Clostridium œdematians*).—This bacillus causes colourless gelatinous œdema, a small amount of gas production, a pale pink colour of the muscles, deep red in heavily infected

areas. (4) *Bacillus sporogenes*.—This bacillus produces an olive green colour of the muscles, the colour turning to black and a putrid odour. The bacillus is usually associated with *B. welchii* and may obscure the features of any of the gangrenous types. These organisms are all saprophytes and can only multiply in *dead* tissue. Some are sugar splitting and others proteolytic. They are spore-bearing anaerobes.

No precise information is available as to why the disease progresses in some cases and not in others ; why it returns after amputation, and why in certain cases treatment fails to arrest it. The advance in most cases is a local one, spreading centrifugally. A death of tissue is a necessary antecedent to the spread of bacteria. There is no difficulty in understanding the spread of infection in a muscle already deprived of its blood supply. The question is what kills the tissues when the blood supply is intact. Taylor advanced the view that the gas produces the death of the tissues by its disruptive effects, but it probably plays a secondary part by causing a tension which interferes with the blood supply. D'Este Emery has shown how the toxin repels the leucocytes ; indeed the absence of any reaction is one of the most striking phenomena often advanced of gangrene. None of the above facts affords an adequate explanation of the death of living tissue. The key to the problem lies in the observation that the bacteria washed free of toxin are comparatively harmless. Calcium salts have an important action in producing conditions suitable for the spores to germinate. Once this has occurred the organisms in the vegetative state elaborate a toxin which in untreated cases prepares the way for a further spread of the condition : (a) by killing the adjoining tissue and (b) by producing intense œdema which curtails the blood supply.

Certain areas of the body are noted to be the favourite sites for the occurrence of gas gangrene. The buttock is the commonest, then the calf and the hamstrings. The trunk is rarely affected and the disease never occurred on the scalp. The neck and erector spinæ are rarely affected.

The incubation period of gas gangrene may vary within wide limits. Definite gangrene with gas issuing from the wounds and œdema has been seen within five hours of the trauma, while on the other hand there are many recorded cases of gangrene having set in weeks or months after receipt of the original wound. These cases have often been associated with some operative procedure.

The starting point of gangrene is generally a wound infected by the passage of a missile with its accompanying layer of clothing or by particles of soil carried in with it. Damaged muscle, owing to the presence of glycogen, forms an ideal site for the development of anaerobic organisms. The production of œdema is the most striking characteristic of gas gangrene ; œdema always precedes gangrene and organisms may be detected in the fluid at levels at which no gangrenous change has taken place in the muscle. According to Wallace, pallor due to swelling of the deeper tissues is the first change noted in the skin ; this is succeeded by a dirty yellow discoloration followed by purple-red patches. The changes in the colour of the muscle

are very constant. In the earliest stages the fibres are pale pink in colour, then the muscle looks puffy and dull in colour. The fibre is non-contractile and sinks in water. Later the fibre changes to green, brown, and finally black ; gas bubbles appear and the muscle has a honeycombed appearance and floats in water.

The bacteria proliferate freely in the wound and may be demonstrated in the tissues well in advance of the gangrenous process. In infections with *B. welchii* or *Vibrio septique* the number of organisms is enormous. In infections with *B. œdematiens* the number is trivial in comparison with the lesions produced. Blood infection is common in *Vibrio* infections, but in *B. welchii* infections it is usually terminal ; in *B. œdematiens* it is less common and also usually terminal. In reported cases of metastatic gangrene *B. welchii* is usually found.

The laboratory diagnosis of the types of bacteria present is difficult.

The examination of films is of limited value. An indication of the infection may be obtained from the appearance of the fluid and muscles. *Vibrio septique* produces a definite red muscle, and rose-red œdema fluid ; *B. œdematiens* a white glairy fluid ; *B. welchii* a bronzing of the skin and brown or yellow discoloration of the muscles.

It is now generally recognized that two or more types of organisms are present in practically all cases of gas gangrene. For this reason multivalent serum is used. Attempts to use monovalent sera have been discontinued. For this reason the identification of organisms as a routine measure is not of practical importance.

The heavy mortality in gas gangrene is due, in part, to a late diagnosis. Early treatment can give a mortality as low as 5 to 15 per cent instead of the usual mortality of 40 to 80 per cent. E. Dunbar Newell points out the great value of roentgenograms in showing the presence of gas bubbles in the tissues, permitting a diagnosis to be made before the physical sign of crepitus. Rinehart was the first to call attention to the value of the roentgenogram in making a diagnosis before the infection is clinically apparent. In suspected cases the roentgenogram should be repeated every four hours. If there is a steady increase of gas bubbles in each succeeding film it may be concluded that they are not due to inclusion of air in the wound.

The surgical factor in the disease is of the greatest importance. When the wounds are opened, cleaned, and drained, there is a great decrease in the number of cases, but it was not until complete excision of the wound became a standard method of procedure that gangrene ceased to be a serious menace. Thus in 1918, in a series of 40,000 wounded from two army fronts, only 400 cases of gangrene were recorded. Towards the end of hostilities the cases in which gangrene occurred were those in which the patients were suffering from severe shock which precluded surgical interference, or those in which loss of blood from a severed vessel rendered the patient's resistance negligible.

As the war progressed delay in treatment was reduced to a minimum. The time factor when infection is established is considered to be of greater importance in gas gangrene than in any other disease.

It is now recognized that in the treatment of gas gangrene all devitalized tissue, especially muscle, must be excised, adequate drainage provided, and the part immobilized. Böhler relies entirely on these measures; he does not even use prophylactic serum, and in 1933 he could write they had never failed. Trueta saw only one case of gas gangrene develop in over 1,000 fractures treated by his methods in Barcelona during the Spanish War, whereas the condition was already present in several patients transferred to his clinic many hours after injury. As we reported in the Editorial on his methods, his experiences emphasize the need of making the interval between injury and operation one of minutes rather than hours. He advocated immediate removal of all cases to hospital and that no time should be spent in first-aid attentions. In the *Lancet* of November 4, 1939, Brittain describes a case in which expectant treatment proved successful. Mitchener and Cowell recommend injection of hydrogen peroxide into the surrounding tissues to prevent the spread of anaerobic infection.

While the treatment of gas gangrene is essentially surgical, there was some evidence, however, in the Great War that antitoxic sera might be of use, but it was not until 1918 that antitoxic sera were used by the British Army. In the winter of 1918 Major Bull, of the United States Army, brought from America a small stock of *B. welchii* antitoxin which was used in a few experimental cases on the British front, but it became evident that to obtain general success it would be necessary to use a serum which contained the antitoxins of other pathogenic anaerobes. In April, 1918, a serum was supplied by Messrs. Burroughs Wellcome which contained the antitoxin of *B. welchii* and of *Vibrio septique*; the titre was not high and the results were disappointing on the whole, but the results in some cases were so striking as to leave no doubt that they were due to serum treatment.

It was considered that the serum should be given early to all wounded men with gross injury of muscle, to all cases in which a large artery is severed, to all cases in such a state of shock that they must be allowed to resuscitate before an operation is possible. The serum should be polyvalent with the weight thrown on *B. welchii* antitoxin. In the case of established gangrene the serum should be given intravenously and in large doses. It should also be injected into the muscles around the focus and by installation into the gangrenous focus. The injections should be repeated every few hours intravenously, and locally at every dressing and operation.

In the summer of 1918 a considerable experiment on prophylaxis was attempted under the direction of Colonel S. L. Cummins. Antitoxin for *B. welchii* was introduced into the antitetanic serum, which was being used as a prophylactic for all wounded. The results showed that the number of cases occurring in the casualty clearing station were not influenced and the incidence at the base was probably diminished. The mortality in the base hospitals was reduced by 50 per cent. Wallace, reporting on this trial, gives the figures from May to September of the wounded who received the combined sera and those who received antitetanic sera only at advanced dressing stations and developed gas gangrene before evacuation from the

casualty clearing stations. He considers this series gives the only reliable figures for the whole campaign. Gas gangrene occurred in a little over 1 per cent of all wounds. There was no appreciable difference in the incidence of the disease receiving the two types of serum.

The French Medical Service used an anti-*welchii*, anti-*Vibrio septique*, and an anti-*œdematiens* serum. The three sera were injected about the damaged muscle in cases in which it was thought gas gangrene was likely to occur. The French reports of this treatment were somewhat enthusiastic. Weinberg placed a more potent serum at the disposal of the French service and good results were obtained by Duval, Chutro and Delbet.

The German surgeons claimed that much benefit resulted in their armies from the use of a polyvalent serum.

Opinions still vary as to the use of antiserum; some workers report successful results from the use of large doses. There is evidence that it is of value in lengthening the incubation period and in lessening the severity of the attack.

*Welch*, *Vibrio septique* and *œdematiens* antitoxin may be administered, either separately or combined. In addition, an injection of one or more of these antitoxins combined with *Tetanus antitoxin* may be given.

The dosage may have to be modified in the light of experience, but the present provisional proposal is as follows:—

*Prophylaxis* as a combined injection.

Welch	..	..	3,000 units
Vibrio septique	..	..	1,500 „
œdematiens	..	..	1,000 „

This is contained in a dose of approximately 10 cubic centimetres.

*Treatment*, 25 cubic centimetres of the above serum (or two and a half times the prophylactic dose) may be given for therapeutic purposes in established cases.

The injection of a polyvalent serum may be replaced by a monovalent serum in areas where experience suggests that this is warranted, or for intensive specific serum therapy in cases in which the causative organism has been identified.

Kelly and his co-workers are enthusiastic about X-ray treatment, and their results justify a trial of the method. There were 29 cases in which amputation was not performed and all the cases recovered. Out of 15 cases who had amputation five died.

Chemotherapy is recommended by Böhlman, who records the recovery of three cases of gas gangrene after treatment with sulphanilamide. Jansen and his colleagues have reduced the incidence of infection in compound fractures by putting crystalline sulphanilamide into the wound before suturing it. On the other hand Kendrick found sulphanilamide and related compounds quite unable to save guinea-pigs experimentally infected with *B. welchii*, but as there is some evidence in their favour, it is thought these compounds should be used in all established cases.

## Clinical and other Notes.

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### A NOTE ON THE PRESENT TREND OF MASTOID SURGERY

BY W. O. LODGE, F.R.C.S. EDIN.

SURGICAL advances are often revivals of ancient methods in the light of modern technique. Such is the transmeatal mastoid operation, so valuable in the treatment of cholesteatomatous cavities, which are thereby opened up for inspection and treatment.

After infiltration with novocain and adrenaline a flap hinged outwards is cut from the postero-superior meatal wall. The incision can be extended forward slightly, just above the tragus, if necessary. No retro-auricular incision is made. Using slender gouges and a wooden mallet the mastoid antrum is opened up. Not so much of the outer wall of the mastoid process is removed as in a typical conservative mastoid operation. In the cases in which a transmeatal operation is indicated the mastoid process is seldom fully pneumatized. Professor Dohleman kindly demonstrated the operation under local anaesthesia in June, 1939, at Lund to a colleague and myself. For my first few operations I was glad to have for reference a dry preparation showing the amount of bone removed. A self-retaining retractor leaves both hands free.

Convalescent patients are not confined to bed, and the dressings are not painful. For after-treatment I suggest ear drops prepared according to the following formula :—

	Acriflavine	0.2	gramme	
	Crystal violet	1.0	„	
	Brilliant green	1.0	„	
Dissolved in	Distilled water (boiling)	50	mils.	
Add	Triethanolamine	2	„	
Mix	Oleic acid	3	„	} sterilized
	Liquid paraffin	75	„	
and add hot to aqueous solution to produce emulsion.				
Dissolve	Chloratone	1.0	gramme	
	Camphor	2.5	„	
	Menthol	1.8	„	

in sterile liquid paraffin 75 mils. Add to above when cool and shake well.

This produces 200 cubic centimetres of an emulsion which disinfects and soothes the tympanomastoid cavity and cleanses the external auditory meatus.

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## EXPERIMENT WITH A SUNLIGHT CLINIC.

BY MAJOR D. W. M. MACKENZIE,  
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AND

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DURING the winter period 1938-39, a sunlight clinic was run at the Royal Victoria Hospital, Netley, with the object of giving a weekly irradiation with ultra-violet light to the children of families of R.A.M.C. personnel.

It was thought that this might be a valuable measure of prophylaxis against the common cold and other minor ailments common to children. The results have been gratifying and it is hoped that publication of these may stimulate interest and example in hospitals where apparatus is available.

### STATISTICS.

Number of treatments given	..	..	773
Average number treated weekly	..	..	34
Duration of course	..	..	October 22, 1938, to March 23, 1939

*Note.*—The posting of families to other units resulted in marked difference in weekly figures which ranged from a maximum of 50 to a minimum of 12.

### RESULTS.

Most of the children were already fit and all that can be said of these is that they developed a healthy and tanned appearance and, with one exception, were free from colds throughout the winter period.

One boy who had a history of delicate health from birth showed a marked improvement and his parents (the best judges!) were both grateful and enthusiastic. They stated that the boy's appetite and general activity were improved and that it was the first winter that he had not had persistent coughs and colds.

In another family where the children were catarrhal a marked improvement was obtained in the specific condition and in the general health.

### TECHNIQUE ADOPTED.

A long flame-cored carbon arc lamp was used. Circles were painted on the floor with radii of 40, 36, and 32 inches respectively from a point taken by plumb line from the burner. This permitted of multiple treatments, as many as ten children being treated at the same time. Radiant heat baths were placed in the cubicle to maintain a comfortable temperature.

The children were stripped except for knickers and shoes and were made to wear goggles (the latter borrowed from the Hospital Quartermaster's P.A.D. stock!). In the case of babies (between 1 and 2 years) a separate clinic was run and the mother was in attendance. The baby sat on the mother's lap and where there was difficulty in making the child wear goggles



the mother was instructed to hold a piece of black X-ray paper between the lamp and the child's face.

Dosage was strictly progressive and is indicated by the following table :—

*With Long Flame-Cored Carbon Arc.*

1st treatment: 1 minute to back and front at 40 inches.

2nd     "                 "                 "                 "                 38     "

3rd     "                 "                 "                 "                 36     "

Time increased thereafter by  $\frac{1}{2}$  minute each consecutive exposure until a maximum of 5 minutes to front and back was being given.

*Alternative Table with Alpine Sun Mercury Vapour Lamp.*

1st treatment: 1 minute to back and front at 36 inches. Increase weekly by 20 seconds until 3 minutes reached, and remain at this.

### CONCLUSIONS.

It would seem that a sunshine clinic serves a good purpose at an age when the subject requires biological stimulation and at a period when this is, in many instances, subnormal.

The fact that a flaming arc lamp may not be available will prevent multiple treatments being undertaken and thus limit the numbers it is possible to treat.

Most hospitals have an alpine sun mercury vapour lamp. It is suggested that in this case any subnormal or weakly children should be selected to undergo a tonic course, the children to be chosen by the families' M.O. with the co-operation of the parents.

In conclusion it must be noted that the personal element must be provided for. The fair child requires (or will tolerate) less than the dark child. The dosage should be gradually increased until pigmentation or a barely perceptible erythema is obtained.

### A CASE OF MYASTHENIA GRAVIS.

BY CAPTAIN R. STJOHN LYBURN, M.D.,

*Royal Army Medical Corps.*

THE patient, a Greek aged 23, was the wife of a Flight Serjeant in the R.A.F. Her occupation before her recent marriage was a dressmaker.

On her 21st birthday she was in excellent health, but shortly afterwards suffered from severe occipital headaches. A year later she noticed that her right ring finger would tire quickly when she was engaged in dressmaking. This weakness became intensified the longer she continued to use the finger, but regained its strength after a short rest. A fortnight later she noticed her right hand begin to drop and the left ring finger became similarly affected to the right. In a short time the fingers of both hands were affected and she

had difficulty in dorsiflexion of the wrist. These symptoms only came on about three-quarters of an hour after commencing her dressmaking.

This condition of "weakness on muscular exertion" progressed fairly rapidly and the patient soon found that she was unable to lift up her right arm, even after a short time at dressmaking. She was therefore compelled to give up her work.

Two months after she noticed the tiredness in her right ring finger, symptoms appeared in the lower extremities. These were first manifested by the patient twisting her ankle frequently after a short walk. On rising in the morning after a night's rest she felt well and did not notice any weakness.

Then her head began to fall forwards and she would have to support it with her hands; as the day progressed the tiredness in her legs increased until she could only walk a short distance. After a rest the strength in her legs would recover, but after another short walk she would be compelled to rest owing to weakness in the crural muscles. In this state she was married to an airman.

The muscles of the tongue were the next to be involved, and when I last saw her she was suffering from dysphagia resulting from involvement of the pharyngeal muscles.

Diplopia set in eight months after the disease became manifest.

The patient attended the antenatal clinic of the Military Families' Hospital, Mustapha, where it was noticed that she had ptosis of the left lid. The above account of the illness was then elicited. She was four months' pregnant. Her husband was informed of the seriousness of the illness, and it transpired that she had been attending a Greek neurologist in Alexandria, who had prescribed tablets which gave her great relief, though only temporarily. These were found to be prostigmin.

She is now quite unable to swallow food or fluid without this drug. Other distressing symptoms were insomnia, pain in the back in almost any position, and halitosis. She has marked weakness in all her limbs, sits up with difficulty, and is unable to close her eyes tight or purse her lips to whistle.

Examination of the central nervous system revealed no abnormality. The knee-jerks were present, though sluggish. Sensation was unaffected. Physical examination of other systems showed nothing abnormal. Electrical tests to show the "myasthenic reaction" were not performed.

Her existence is entirely dependent on prostigmin (Roche), a synthetic physostigmine. Each tablet of 0.015-gramme causes recovery of the affected muscles in about ten minutes, and lasts for two hours. She frequently has to take seven tablets daily, but can usually manage with five.

Apart from being such a distressing illness it is also very costly. Every fifth day she has to buy a bottle of prostigmin tablets, the cost of which is PT 40 (about 8s.).

The question as to the advisability of terminating the pregnancy arose. Most authorities state that pregnancy usually causes an abatement of symptoms, but this has not been so in this patient.

Dr. Solomons, ex-Master Rotunda Hospital, is in favour of terminating the pregnancy if the patient's condition deteriorates.

*Comment.*—The following excerpt is from Beaumont's "Medicine":—

"The cause of myasthenia gravis is unknown. The disease appears to be due to chemical abnormality which results in a defect of the transmission of the impulse from the nerve to the muscle. Acetylcholine is the chemical substance which allows transmission of impulses across the myoneural junctions in striated muscles, but acetylcholine itself has no beneficial effect on the disease. It is thought that eserine and prostigmin inhibit the destruction of acetylcholine by an esterase."

I am indebted to Lieutenant-Colonel R. H. Alexander, M.C., M.B., R.A.M.C., S.M.O., Alexandria Area, for permission to forward these notes for publication.

This case came under the care of Captain G. W. D. Reeves, Royal Army Medical Corps, in the April of last year.

She was then attending the antenatal clinic at Mustapha Military Families' Hospital. She was due to go into labour on or about August 27, 1939.

*August 1:* Whilst in her quarters she suddenly developed an acute exacerbation of symptoms, and was experiencing great difficulty in breathing. Oral prostigmin could not be given as she was completely unable to swallow. An intramuscular injection of 1 c.c. was given and she recovered in a few minutes. She was removed to the Families' Hospital; then it was noted that instead of using her usual five tablets per diem she now needed eight plus also the occasional intramuscular injection.

*August 11:* It had been previously decided that the patient should be transferred to Cairo, but owing to her serious condition this was impossible. She developed early labour pains and there was still a hope that she might be delivered in a normal manner, but soon it became obvious that this was impossible. The uterine contractions, although very painful, were very weak, the cervix was never completely taken up (all examinations were done rectally in case Cæsarean section should be decided upon). Membranes were unruptured.

*August 13:* It was decided to perform a classical Cæsarean section.

*Operation.*—The abdomen was opened through the usual incision. A living female child, weight 8 pounds, was delivered. After delivery of the child the patient collapsed and was revived with prostigmin and coramine. (It is of interest to note that the rectus muscles were practically non-existent and consisted solely of a very thin sheet of muscle fibres.)

*Convalescence.*—She has shown a slight improvement and now consumes only five tablets per diem.

The prognosis as to life is of course very grave.

**MEDICAL SOCIETY OF THE VTH CASUALTY CLEARING STATION.**

**PRESIDENT : COLONEL F. R. COPPINGER, O.B.E.,**  
*D.D.M.S. II Corps.*

WE have received the following notes regarding the formation and proceedings of the Medical Society of the Vth Casualty Clearing Station.

The first meeting of the Medical Society, Vth Casualty Clearing Station will take place on Sunday (14.30 hours), December 17, 1939, at the Casualty Clearing Station.

**AGENDA.**

*Business Meeting.*

Discussion to decide the following :—

- (a) The most convenient places to hold future meetings of the Society.  
To settle dates and times.
- (b) The question of formation of scientific meetings into Sections.
- (c) The relative length of time proposed to be allotted to demonstrations (of a clinical or laboratory nature) and to papers.
- (d) Arrangements for reception of papers to be read at future meetings, allotment of time to be given for such papers, arrangements as to meetings at which these papers will be read.
- (e) Any other business.

*Scientific Meeting.*

A demonstration of the medical and surgical equipment of a casualty clearing station with some examples of its recent application to be given by Major G. R. McNab, M.D., F.R.C.P.Edin., R.A.M.C., and Captain P. H. Lenton, M.B., B.Ch., R.A.M.C.

C. S. P. HAMILTON,  
*Major, R.A.M.C.,*

*December 8, 1939.*

*Hon. Secretary, Medical Society, Vth C.C.S.*

**MEETING.**

A meeting was held at the Vth Casualty Clearing Station on December 17, 1939, the President and 26 members being present.

The following points were discussed and agreed upon :—

(a) That future meetings would, when possible, be held at various centres, such as field ambulances, if their Commanding Officers agreed to this proposition. However, before a decision is made as to the meeting places their accessibility for the majority of members would be considered.

It was agreed that the next meeting be held at Vth Casualty Clearing Station on December 31, 1939, at 14.30 hours.

(b) It was agreed to divide the Scientific Section into three subsections,

Surgical including Dental Surgery and Radiology, Medical including Bacteriology and Hygiene, Dermatological and V.D.

Major L. O'Shaughnessy was elected Hon. Secretary of the Surgical Subsection.

Major G. R. McNab was elected Hon. Secretary of the Medical Subsection.

Major Cliff, VIth Casualty Clearing Station, Hon. Secretary of the Dermatological and V.D. Subsection.

(c) It was agreed to ask members to send their papers for Section meetings to the appropriate hon. secretary, and that these secretaries should select papers to be read and pass them on to Major C. S. P. Hamilton, the Hon. Secretary of the Society.

(d) That twenty minutes be given for each paper and fifteen minutes for discussion.

Major McNab and Captain Lenton gave a short discourse on the work carried out at the casualty clearing station. They gave details of three interesting types of cases. One a meningitis in a patient who was being treated for gonorrhœa with M & B 693 in which no organisms could be found in the cerebrospinal fluid though this contained 700 cells. Culture and guinea-pig tests were negative. The case responded to rest and sulphanilamide, and on transfer to the Base the symptoms and signs had subsided. The two other patients were admitted for hæmaturia and renal colic supervening after treatment for gonorrhœa by normal courses of M & B 693. In these two cases typical lens-shaped and broomstick crystals of M & B 693 were found in the urine. The question arose as to whether these patients had taken a sufficient quantity of fluid during treatment.

A case of spontaneous pneumothorax was diagnosed and successfully treated by operation with a modified Maxwell's pneumothorax apparatus. This was interesting as it is probably one of the first cases of its kind to be treated by this method in a casualty clearing station.

Medical and surgical equipment was demonstrated, and points of interest regarding deficiencies and sufficiencies were discussed in relation to the requirements of a casualty clearing station.

At the next meeting on December 31, 1939 (at Vth Casualty Clearing Station, 14.30 hours), Major L. O'Shaughnessy, F.R.C.S., and Major G. R. McNab, F.R.C.P.Edin., will demonstrate Surgical and Medical Equipment used in the modern treatment of chest diseases, and will deliver a short discourse on the subject.

C. S. P. HAMILTON,

*Major, R.A.M.C.,*

*December 20, 1939.*

*Hon. Secretary, Medical Society, Vth C.C.S.*

## Echoes of the Past.

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### TWENTY YEARS AFTER.

BY H. SKIPTON STACY, M.D., Ch.M.(Syd.), F.R.A.C.S.

*Honorary Consulting Surgeon at Sydney Hospital, Ryde Hospital, and Royal South Sydney Hospital.*

(Continued from p. 61.)

### III.—GUNSHOT WOUNDS OF ABDOMEN.

#### CASE 5.—Acute Pyelo-Nephritis.

*Clinical History.*—Nature of wound : Bullet wound of sacral region.

Signs and symptoms : Temperature 101° F. shortly after admission, and increasing each night, rising to 105° F. Needed to be catheterized ; urine is slightly turbid. Pulse 120. Abdomen : Distended in lower portion but not rigid.

X-ray report : There is a rifle bullet to left side of the sacrum.

Operation : Wound opened up and drainage tube put down to the depth of the wound.

Survival : Fourteen days.

*Post-mortem Result.*—Abdomen : Peritoneal cavity, normal, except slight adhesion of small bowel to the bladder, which was distended. Bullet was found on the left side of the pelvis extraperitoneally ; just where the X-rays had located it. The track of the bullet was extraperitoneal throughout ; the cellular tissue was quite healthy. The bladder showed most acute inflammation ; the ureters were also inflamed ; the left kidney was very much enlarged, and showed intense pyelo-nephritis ; the right kidney was normal in size, and also showed most acute pyelo-nephritis. (There were hæmorrhagic pus foci on the cortex.)

Pathological report : Examination of the urine some days before death showed abundant pus cells, and a pure culture of streptococci.

Comments.—The clinical diagnosis was pelvic cellulitis and suppuration, but this was wrong. Death was due to acute pyelo-nephritis, as the result of infection by the catheter.

#### CASE 6.—Wound of Small Bowel and Bladder.

*Clinical History.*—Nature of wound : Multiple wounds of right buttock, sacral region, and lower part of left rectus.

Signs and symptoms : Liver dullness present.

Survival : Several hours.

*Post-mortem Result.*—Abdomen : Small bowel wounded in eight or nine different places ; in one place there was a complete wound through

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*Post-mortem Result.*—Abdomen : Small bowel wounded in eight or nine different places ; in one place there was a complete wound through



into the mesentery in two places, isolating a loop two inches or so long. In the other positions the wounds were through one wall only ; in each case the mucosa was extruded, giving a rosette-like appearance. There was a little hæmorrhage (not more than half a pint) into the peritoneal cavity, chiefly in Douglas' pouch ; no fœcal contents were seen. The symphysis pubis was shattered, and the bladder could scarcely be recognized ; it was completely torn away.

CASE 7.—Wound of Small Bowel and Colon.

*Clinical History.*—Nature of wound : Shrapnel in abdomen and face.

Signs and symptoms : Conscious though very collapsed ; deaf ; pulse not palpable. Abdomen : Wound in left hypochondriac region ; no distension, not much rigidity. Liver dullness present.

Operation : Was immediately put under an anæsthetic (oxygen, and ether warmed). Given a pint and a half of intravenous saline and 1 c.c. pituitrin ; median laparotomy ; piece of shrapnel found just near the wound projecting into iliac colon ; removed and wound sewn up. Also small intestine wounded in two places, both through-and-through. (In one, wound of the mesentery also.) Bowel sutured. At the other wound about two inches of bowel were resected. Some dark fluid blood and blood-clot in the peritoneal cavity, but no active bleeding.

Survival : Several hours.

*Post-mortem Result.*—Abdomen : The wounds were in the lower part of the jejunum ; the bowel for three feet above and six or seven feet below contained a large quantity of dark blood. The upper part of the jejunum and stomach were dilated.

CASE 8.—Wound of Small Bowel. Shock.

*Clinical History.*—Nature of wound : Bullet wound of the abdomen. Said to have been about 1,000 yards behind the Front Line.

Signs and symptoms : Pain across the lower abdomen ; is cold, pale and collapsed. Pulse 108, fair volume. The day after operation pulse was not palpable, colour slightly livid ; quite conscious. Was moved to the operating theatre for a blood transfusion, but the movement caused him to become worse, and he died on the table.

Operation : On the operating table two hours after being hit. Wound one and a half inches below and to the left of the umbilicus ; dark blood oozing out of the wound in good quantity. Liver dullness present. Median laparotomy was performed. Several pints of blood in the peritoneal cavity ; iliac colon wounded in several places ; small bowel shot completely across (transversely), in several places, and wounded in several others. Wounds were sewn up, and end-to-end anastomosis done. Peritoneal cavity washed out with saline, and a drainage tube inserted in the flank. Intravenous saline and pituitrin given. Operation took two and a half hours, pulse remained good until towards the close.

*Post-mortem Result.*—Abdomen : No fresh lesions or hæmorrhage. Acute hyperæmia of the small intestine due to early peritonitis so that he would have died in a few days in any case.

Comments : Probably excision of a foot or two of bowel rather than taking time sewing up each wound would have been better. Possibly it would have been wiser to use a Murphy's button to save time in the anastomosis. It would have been better if he had not been moved from the ward to the theatre for the proposed blood transfusion.

CASE 27.—Wound of Bladder. Pelvic Cellulitis and Suppuration.

*Clinical History.*—Nature of wound : Gunshot wound, leg, buttock and abdomen.

Signs and symptoms : Admitted about seven hours after having right foot blown off ; also with a wound of the right buttock, and some wounds of the left leg. Is very pale, collapsed and shocked, though quite conscious. Complains of pain just above left Poupart's ligament, and is tender there on pressure. Abdomen shows generalized rigidity. Liver dullness, normal. Urine is very blood-stained. The day after operation was feeling well, slightly offensive odour on the tube when withdrawn from the space of Retzius. Some distension in the lower part of abdomen, especially in the mid-line. Vomiting. Next day vomiting ceased ; abdomen not rigid ; but he looks very pale and very ill. Temperature normal, pulse 110 feeble. Died.

X-ray Report : Showed large piece of shrapnel about two and a half inches from the symphysis pubis slightly to the left of the mid-line ; the edge of the pubic bones at the symphysis had been chipped, the small fragments being seen in the radiographs at distances varying from one to two inches from the point of origin.

Operation : Given pituitrin and one and a half pints of intravenous saline. The peritoneal cavity was opened but found to be normal. The bladder, when distended with saline, leaked slightly extra-peritoneally just to the left of the symphysis. The bladder was opened extraperitoneally, a piece of shrapnel found in it, and extracted. A catheter tied in and a drainage tube put in the space of Retzius.

Survival : About sixty hours.

*Post-mortem Result.*—Abdomen : Laparotomy wound in its lower part dark and foul-looking ; tissues in the space of Retzius dark, foul and purulent ; this condition extends down on either side behind the peritoneum on the right side to the muscles near the great sciatic notch, through which the track of the missile led ; on the left side the infection had spread into the muscles on the brim of the pelvis, and was extending slightly down the thigh. Bladder opened ; mucous membrane dark and foul. Kidneys healthy. Peritoneal cavity, normal. The track of the gluteal wound was foul and dark looking, but the muscle around was perfectly healthy.

Bacteriological Report (No. 5 Canadian Laboratory) : The films made

from the pus showed organisms to be present in very large numbers, a Gram-positive coccus predominating ; a large Gram-positive bacillus is also present in fairly large numbers.

Comments : Again the temperature was misleading ; even the pulse was not very informative. Possibly if the space of Retzius had been more thoroughly opened and drained in the first place it might have helped, but the track was so deep and long that probably nothing could have saved him.

CASE 29.—Wound of Splenic Flexure and Stomach. Peritonitis. Wound of Lung and Bronchopneumonia. Subphrenic Abscess.

*Clinical History.*—Nature of wound : Gunshot wound, chest and abdomen. (Minnenwerfer.)

Signs and symptoms : Admitted with shell-wound of left side of chest and loin. Temperature  $97^{\circ}$ , pulse 120. Hæmaturia for three days. After some days, although he was not very ill (temperature  $100^{\circ}$ , pulse 124), vomiting continued ; the abdomen was not rigid or distended. Laparotomy was performed. He was better for a day, then temperature rose to  $103^{\circ}$ , pulse remaining about 120. The following day was dressed under an anæsthetic ; the loin wound had not been cleaned up well by the salt pack ; this was altered to eusol, but the temperature and pulse remained up. About four days after the anæsthetic, temperature dropped suddenly to  $97^{\circ}$ , and he died. (On one day he had a little offensive sputum.)

Operation : Shortly after admission he was operated on and the wounds cleaned up ; one tube inserted into the depth of the retroperitoneal loin wound, another into the pleural cavity. Several days later, laparotomy was performed ; the lesser peritoneal cavity opened, and gas escaped ; no other contents ; a leak of the splenic flexure into the lesser sac was found ; this was sutured, a rubber drainage tube introduced, and brought out through the abdominal wound.

Survival : Lasted about seven days.

*Post-mortem Result.*—Chest : There was a wound through the rib into the left pleural cavity and through the diaphragm into the peritoneal cavity. Some blood-stained uninfected fluid in the left pleural cavity, and even more in the right. Diaphragmatic pleurisy on the left side ; edge of the lower lobe of the left lung bruised. The whole of the left lung exceedingly œdematous, with patches of bronchopneumonia in the lower lobe. Right lung œdematous to a lesser degree ; no certain bronchopneumonic patches seen (though portions of the lower lobe were suspicious).

Abdomen : No general peritonitis. The splenic flexure wound was apparently all right, but there was a perforation on the posterior wall of the stomach (possibly due to the tube) ; much pus in the lesser sac ; it was escaping out of the foramen of Winslow into the right flank ; it was also subphrenic on the left side. The left kidney was contused at one spot on its convex border.

Bacteriological Report : Smears from both lungs are identical ; they

show a large Gram-positive bacillus (morphologically similar to *Bacillus aerogenes capsulatus*) in large numbers. A lanceolate Gram-positive diplococcus (morphologically pneumococcus) is also present in small numbers.

Comments : Beware of upper abdomen lesions ; they may give few abdominal symptoms (although vomiting seems pretty constant).

CASE 31.—Wounds of Small Bowel, and Peritonitis.

*Clinical History.*—Nature of wound : Gunshot wound, abdomen.

Signs and symptoms : Abdomen rigid. Wound in the left flank ; swelling over the right rectus. Cyanotic during the last twelve hours of life. Sputum has been blood-stained. Given oxygen.

Operation : Under ether, median laparotomy performed ; shrapnel removed from rectus. Small bowel wounded in several places within a few inches ; some contents extruded and early peritonitis present. Extruded matter wiped away, and the holes in the bowel sewn up. A drainage tube put in the loin wound, which was excised.

Survival : About two days.

*Post-mortem Result.*—Chest : A little blood-stained serous fluid present in both pleural cavities. Lower lobe of the left lung very dark. On section it is extremely congested ; no definite area of consolidation seen, but small pieces sink in water. Upper lobe more crepitant. Bronchi of both lungs are very hyperæmic. Right lung is congested, but crepitant. The heart is normal.

Abdomen : Some distension. Stomach, duodenum, and the upper four feet of the jejunum are very distended and hyperæmic, down to a spot where the bowel had been sewn, and to which the omentum was adherent ; two loops of bowel were adherent at this spot, causing some kinking, but obstruction was not complete ; the bowel below was a little less than normal in calibre, the lower part was quite collapsed.

Comments : Colonel Rigby says that wounds are better sutured (purse-strings) if possible ; it causes much less shock than resection. If resection is done, clip the edges of the mucosa away ; less liability then of distension of the proximal segment ; this is also avoided if the segment of bowel is milked after the anastomosis is performed. Some think lateral anastomosis is better than end to end.

CASE 35.—Wound of Spleen, Colon, and Kidney, with Perinephric Hæmorrhage. Peritonitis.

*Clinical History.*—Nature of wound : Gunshot wound, abdomen and chest. (Minnenwerfer.)

Signs and symptoms : Very cold and collapsed, but conscious. Temperature 97°, pulse 156 very feeble. Wound on the left side of the abdomen through which omentum is protruding.

Operation : Under open ether the omentum was ligatured off, and two tubes put into the peritoneal and pleural cavity. Died several hours after operation.

Survival : About twelve hours.

*Post-mortem Result.*—Chest : In the anterior axillary line, going through the ninth rib and ninth interspace, was a wound leading through the lowest part of the left pleural cavity (in which there was a large amount of blood) ; the lower lobe of the lung was quite collapsed.

Abdomen : Through the diaphragm there was a wound just grazing the anterior border of the spleen, and leading to a lacerated wound (or wounds) of the transverse colon just beyond the splenic flexure. There was some free blood in the lesser peritoneal cavity ; also in the greater.

Behind the descending colon and around the left kidney there was effusion of blood. The upper pole of the left kidney was also contused. Some faecal contents (not in great amount) were free in the peritoneal cavity. A few coils of small intestine were distended, and hyperæmic as if in the early stage of peritonitis.

CASE 36.—Volvulus and Peritonitis following Wound of Bladder and Bowel.

*Clinical History.*—Nature of wound : Gunshot wound, abdomen, thigh and buttock, with compound fracture of tibia and fibula.

Signs and symptoms : Pale and collapsed, temperature 98°, pulse 142. After operation, bladder drained well, and he did well for several days. Temperature between 100° and 101°, pulse 140. After gas anæsthesia on the third day for the purpose of changing the leg dressing, he was not so well. Vomited ; conjunctiva slightly icteric (?). Abdomen distended.

Operation : Leg dressed and set. Suprapubic incision made ; tissues overlying the bladder were swollen and œdematous ; some free fluid in the abdominal cavity. A split tube with gauze passed down into the pelvis with the idea of shutting off a lesion of the bladder from the peritoneal cavity. Bladder then drained suprapubically.

Survival : About four days.

*Post-mortem Result.*—Abdomen : Wound through the left side of the bladder extraperitoneally, going right through and coming out into the peritoneal cavity on the right side. The last sixteen inches of ileum were very congested, and adherent in several places ; at a spot twelve inches from the cæcum there was a marked bruising (about the size of a shilling) of the ileum, with a very small perforation, which was sealed over ; four inches higher up another bruise, but no perforation. The bowel above was slightly twisted at its junction with this piece ; also markedly distended and hyperæmic. The mucosa of the last sixteen inches of ileum was intensely congested. A Meckel's diverticulum was present. The sigmoid and the colon were distended, so evidently the obstruction was not complete. No free fluid in the abdominal cavity. No leakage of urine.

CASE 37.—Hæmothorax. Perforating Wound of Stomach and Hæmo-peritoneum.

*Clinical History.*—Nature of wound : Gunshot wound, chest.

Signs and symptoms : Collapsed ; cold ; temperature  $98^{\circ}$ , pulse 135. Vomited blood several hours later. Abdomen rather rigid ; not much movement, particularly in the lower part. Next morning he was very pale, but quite conscious. Pulse very feeble. Abdomen : Liver dullness present. Chest : On both sides the resonance is impaired. Heart : Apex beat not palpable. Conscious almost to the end.

Survival : About twelve hours.

*Post-mortem Result.*—Chest : Wound at the back of left side of chest. A good deal of dark blood in the left pleural cavity ; lung collapsed (especially the upper lobe) ; lower lobe shows hypostatic congestion. Right side, normal except for hypostatic congestion.

Abdomen : Abdomen distended ; gas escaped on opening peritoneal cavity ; dark blood in abundance especially in the right flank and pelvis. Liver normal ; upper surface quite uninjured. Left kidney : Slight hæmorrhage in the upper pole and surrounding perinephric fat, which adjoined the track of a piece of shrapnel which entered the back about two and a half inches from the mid-line ; going through the eleventh intercostal space just into the lowermost part of the left pleural cavity, through the diaphragm, than into the lesser peritoneal cavity, through the posterior surface of the stomach (not far from the cardiac end), embedding itself in the anterior wall of the stomach almost opposite. Spleen : Was very small (due to hæmorrhage presumably) ; uninjured. Other abdominal organs apparently normal. No peritonitis. A peculiar feature was that there was not much blood in the lesser peritoneal cavity, only a little brown grumous fluid (perhaps it had all flowed out ; it was not examined early in the post-mortem).

CASE 42.—Wound of Colon, Spleen and Stomach. Subphrenic Abscess.

*Clinical History.*—Nature of wound : Gunshot wound, abdomen.

Signs and symptoms : Shot through the left 10th interspace just in front of the posterior axillary line. Some shock and pallor for the first two days, with a temperature  $97^{\circ}$  F. and pulse about 100 ; after vomiting the pulse would rise to 140. Vomiting intermittent, not blood-stained. Improved during the next few days. Vomiting less, pulse 90 and regular ; colour improved. Several days later was not so well ; temperature up to  $101^{\circ}$  F., and  $102^{\circ}$  F. in the evening, pulse 110. Some epigastric distension ; bowels normal. Liver dullness, which on the first day was normal, is now very much diminished. Later he had a sunken look ; tongue dry and brown, pulse very feeble ; less vomiting ; chest was normal throughout.

Operation : On the seventh day after admission laparotomy was performed ; blood and gas found ; patient died in a few minutes.

Survival : Seven days.

*Post-mortem Result.*—Abdomen : Free dark blood in the general peritoneal cavity, not in very large amount ; coils of small bowel adherent in places, no general peritonitis. The wound was in the 10th interspace ;

perforation of splenic flexure of colon ; lowest tip of spleen wounded ; also perforation of both walls of the stomach (no blood in the stomach). The cavity between the transverse colon and the stomach walled off with omentum ; this was smooth-lined and contained much blood ; the under surface of both lobes of the liver were covered with blood. Stinking infected blood between spleen and diaphragm. In the transverse colon was a quantity of dark material like dark blood.

Chest : Pleural cavity, normal. Lungs show hypostatic congestion of the posterior portion of the lower lobe. Trachea shows no sign of blood or stomach contents. (It was thought possible that he died of asphyxia under the anæsthetic from stomach contents getting into the larynx and lungs.)

Summary : Perforation of colon, spleen, stomach, with hæmorrhage and subsequent infection (subphrenic abscess).

Comments : Colon wounds. There is a danger of septicæmia coming on rapidly from retrocolic infection. Drain this space through the loin.

(To be continued.)

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## Current Literature.

KERMACK, W. O., and MCKENDRICK, A. G. **Contributions to the Mathematical Theory of Epidemics. V. Analysis of Experimental Epidemics of Mouse-Typhoid ; a Bacterial Disease Conferring Incomplete Immunity.** *J. Hygiene.* 1939, v. 39, 271-88, 5 figs.

The object of a mathematical theory, or interpretation of a biological experiment is to express the observed results as concisely as possible, using the simplest hypothesis capable of providing a satisfactory reproduction of the data. One desires to do this because the mathematical expression will permit of inferences which may, in some cases, be tested by further planned experiment ; in others, rational judgments may be possible respecting conditions which are beyond the range of practical experiment.

In an earlier memoir, the authors showed that some of the most important features of the epidemics of ectromelia reported by Topley and his collaborators could be interpreted on the assumptions that the infection rate, recovery rate, death-rate, etc., were constant. The ectromelia case presented the peculiarities that the incubation period was short and the order of immunity conferred by passing through an attack of the disease high. Kermack and McKendrick have now turned their attention to the more complex problem of mouse typhoid, a disease of relatively long incubation period and such that complete immunity from it is not conferred by surviving an attack. The authors first show diagrammatically, in a very helpful way, the inter-relations of the sub-categories, unaffected, affected, recovered, dead, under which members of a herd must fall, and the meaning of their terminology. If a steady state, viz. not only a constancy of total numbers

but also of the sub-categories exists, then the numbers passing out of any one sub-category into another—say from the unaffected to the affected—must be the same as the number passing into the sub-category. Hence one has a system of simple relations. But the deduction from these simple equations of the various assumedly constant rates of attack, mortality, etc., is not quite simple. Taking the empirical Life Tables of the experimenters as summaries of the facts, it is clear that the Life Table values are functions of the various rates and consequently that the various parameters characteristic of the requirements of a steady-state, mentioned above, could be deduced in a mathematical way from the Life Table values. The greater part of the memoir is devoted to this work. The most difficult step is that imposed by the existence of an incubation period of appreciable length. As so often happens in such work, the “obvious” plan of assuming that the death-rate is zero from the time of infection until the  $n$ th day of the disease, leads to insuperable mathematical difficulties. So the authors adopted a most ingenious device for avoiding this. They assumed new sub-categories, into which infected animals entered; the infected might either recover or become doomed to die, i.e. one forms sub-categories of recovered or moribund. This assumption made the mathematical problem soluble. A point of special interest is that the symmetry of the algebra led to the conclusion that a steady state might be reached in two different ways. “According to the first interpretation the disease is relatively highly infectious to the new entrants into the cage, but the course of the malady in the animals, once they have become infected, is slower. The ratio of the chances of death and recovery is approximately the same for both cases, but if recovery takes place the animals, according to the first interpretation, will have attained a higher degree of immunity. In the first case the population in the steady state condition contains a relatively smaller number of virgins, but a correspondingly larger number of diseased, the number of recovered being nearly equal in the two cases.” Since in the routine conduct of a long experiment one must be content with knowledge of the pathological state of the (uneaten) dead alone, we have here a matter which can only be settled by very special experimentation, e.g. by sacrificing the entire herd at a particular point of time. The point illustrates the suggestiveness of mathematical interpretation.

The memoir deserves careful study; it is a valuable contribution to knowledge.

M. GREENWOOD.

*Reprinted from “Bulletin of Hygiene,” Vol. 14, No. 9.*

**SPITTA, O. Significance and Value of the Total Count in the Bacteriological Test of Water.** *Gas-u. Wasser.* 1939, v. 82, 18. [Summary taken from *J. Amer. Water Works Ass.*, 1939, v. 31, 912. Signed Max Suter.]

The total count has three purposes: (1) Measuring the organic pollution, (2) determination of the efficiency of natural or artificial filtration, (3) testing



the effect of disinfecting agents. To measure pollution the oxygen consumed test, the B.O.D. value or the chlorine number can be used ; but for very slowly flowing waters the total bacterial count is the most sensitive test for determination of local pollution or for the checking of self-purification. In testing for soil pollution it is always more important to make local sanitary surveys than to depend on a single laboratory test. Only a series of laboratory tests made on samples taken under different weather conditions can improve on local inspection. A total count is mostly without significance in water from dug wells, and for many hygienic considerations only the test for coliform organisms is of value. In artificial sand filters we get a true picture of the efficiency of the filter only when it is operated uniformly. Any interruption or forcing of its action causes an increase in the total count. The numerical result of the total count is generally not as important as are changes in its value. The limiting allowable number of 100 bacteria per millilitre should not be taken rigidly but should be considered more as meaning a number with two ciphers. Many other practices in bacteriological testing are followed too much according to schedule without consideration of the scope of the test and the possibility of variation. Many times field observations are of more value. Tests for *Esch. coli* or biological examinations should often be made instead of total counts.

*Reprinted from "Bulletin of Hygiene," Vol. 14, No. 9.*

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## Reviews.

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**FRACTURES AND OTHER BONE AND JOINT INJURIES.** By R. Watson-Jones, B.Sc., M.Ch.(Orth.), F.R.C.S. Edinburgh : E. and S. Livingstone. 1940. Pp. xii + 723. Illustrations 1,040 (many coloured). Price 50s.

Mr. Watson-Jones, of the Liverpool School, has just published not only one of the best illustrated and annotated volumes we have read for some time, but a book which we feel sure will be regarded as the most authoritative work of purely British origin on this subject.

To describe a book based on the careful notes and follow-up of over 40,000 cases as "no more than a brief review of the whole subject," will not conceal the immense amount of work entailed in assembling and condensing the text. The author and the publishers are to be congratulated.

Part I deals with principles of fracture treatment and the theories on such subjects as ossification, repair, various influences affecting bone structure, etc. This section is alone worth careful study. The author's clear reasoning and lucid style brings out even old-established facts in such a way that they appear in a new and vivid light.

The remaining five sections cover the whole field of fracture work, and

indicate that Mr. Watson-Jones holds strong views on methods of treatment of many types of injury, and these views and methods are presented in a manner which leaves no room for doubt. The many excellent reproductions of photographs and line drawings naturally assist him enormously in accentuating and bringing out his points.

To those who may be engaged at any moment on the surgery of war wounds this book should make a special appeal.

Once more we are reminded that the key-note of fracture treatment after reduction is immobilization (rest), prolonged and complete, while, at the same time, all related muscles are permitted and encouraged in active movement, always provided that such voluntary action will produce no movement (rotation or shearing strain) at the fracture site. The medium employed, in the vast majority of cases, to obtain this essential combination of rest and active movement, is the moulded unpadded plaster of Paris splint.

The book is printed on excellent paper, well indexed, and in general is a credit to the author, his collaborators, and the publishers.

D. C. M.

**THE SANITARY INSPECTOR'S HANDBOOK (4TH EDITION).** By Henry H. Clay, F.R.San.I., F.I.S.E. London: H. K. Lewis and Co., Ltd. 1939. Pp. xxii + 514. Price 17s. 6d.

The demand for this valuable handbook, coupled with the recent changes in public health legislation, has necessitated the bringing out of yet another edition—the fourth in a little over six years.

It coincides with the coming into operation of the Foods and Drugs Act, 1938, and is an up-to-date compendium for all whose lot it is to study public health or who are concerned in public health administration.

No effort has been spared by the author to ensure that the book includes details of all recent legislation, and full revision in other ways has been carried out.

The author must again be congratulated on the clarity of the illustrations with which the book is profusely endowed and which are of the greatest assistance to readers of the subject matter. He is to be particularly complimented also on the new diagram illustrative of the legal differences between drains and public and private sewers, which appears on page 193. It is a masterpiece of ingenuity.

The author introduces his readers to the latest method of filtration of water by the principles embodied in the meta-filter—an apparatus suitable for domestic and field use—and gives an excellent diagram illustrative of this type of filter.

It is difficult to find any material points for criticism, but perhaps it is regrettable that more stress should not have been laid on the chemical treatment of water by superchlorination followed by dechlorination with sodium thiosulphate, a method which is coming into much more extended use than formerly.

Also, perhaps, apropos of the disposal of dry refuse, a little space might have been devoted to the "Hyganic" process, with which such excellent results are being achieved.

These criticisms are, however, of minor importance, and are mere drops in the ocean of praise which the book deserves. It forms an essential volume for all interested in public health, and can be most confidently recommended to them.

**MEDICAL ORGANIZATION AND SURGICAL PRACTICE IN AIR RAIDS.** By Colonel P. H. Mitchiner, C.B.E., K.H.S., F.R.C.S., and Colonel E. M. Cowell, D.S.O., T.D., F.R.C.S. London: J. and A. Churchill, Ltd. 1939. Pp. viii + 247. Price 10s. 6d.

Owing to an unfortunate misunderstanding, the notice which this publication deserves appears only now in the *Journal* which should have been among the first to draw attention to its merits. For both editors are not only distinguished medical officers of the now incorporated Territorial Army who served with distinction in the last war, but the Foreword is written by Sir Cuthbert Wallace, whose work with the B.E.F. in France and Belgium, as consulting surgeon is a byword with all of us. Published early in the year, when the political skies in Europe indicated the approaching storm and accounts from Spain suggested what might be expected, this useful book came just at the right time. By pointing out the lessons learned in the last war and some of the later experiences in the Spanish fighting, it provided just the information required and sought for by all without previous experience of war surgery, as well as indicating what might be expected in air raids. The value of the book was obvious and its popularity and utility assured. Further observations would be superfluous, but one cannot help feeling that when the authors and the publishers could turn out this book of nearly 500 pages for the modest sum of 10s. 6d. they were prompted more by patriotism than the prospect of personal gain.

D. C. M.

**ARTIFICIAL LIMBS IN THEIR RELATION TO AMPUTATIONS.** Published by H. M. Stationery Office. Price 3s.

From the good old days of the peg leg as worn by that prince of pirates, Long John Silver, of "Treasure Island," or the makeshift arm of Captain Hook, immortalized by Barry, up to the almost dressy prosthesis of the present day is—well—goodness knows how long! The wearing of such rudely fashioned limb substitutes by these bold and bloody buccaneers even enhanced their villainous appearances. The stumping, half-hopping gait of Long John, with his jerkily circumducting contraption, was indeed part of his general make-up, as was the primitively prehensile and menacing hook of the other sinister ruffian.

By comparison, modern prostheses are so nearly perfect, both mechanically and in appearance, that it is often quite difficult to realize that the wearer

has had the misfortune to lose a limb. As far as comfort and utility go, there is literally no comparison.

Most of the credit for such advances must go to the Ministry of Pensions and its surgical and orthopædic advisers. Shortly after the Great War, experienced surgeons appreciated the difficulties connected with fitting such cases with suitable artificial limbs, and considered that certain types of amputation were hopeless. Consequently many erstwhile reputable amputation methods have been relegated to the museum or surgical scrap-heap. The Ministry was not slow to appreciate the situation and all pensioned amputation cases were soon under their control, or segregated at Queen Mary's Hospital (for the limbless) at Roehampton. Ideas soon began to crystallize. Advice on how, when, and where, to amputate was broadcast to the profession, while the limb-makers improved their mechanical contrivances. To-day at Queen Mary's Hospital there is an expert staff and a limb factory, unique in the world, which supplies limbs not only for this country, but to most of the British Colonies and Dominions.

Officers who have attended courses at the Royal Army Medical College will remember the intensely interesting lectures delivered by Dr. Kelham and Captain Maxwell, and the surprising demonstrations given by many willing patients. After such an afternoon, one could not help wondering whether the fate of Ben Battle, the hero of that pathetic ballad, "Faithless Nelly Gray," might not have reacted to-day, and especially as we find ourselves involved in yet another war, in a different way. You may remember that Hood states that he

" . . . was a soldier bold,  
And used to war's alarms,  
But a cannon-ball took off his legs,  
So he laid down his arms! "

One likes to imagine that to-day he would surely have snatched up his arms again, together with a pair of "central knee-controlled lower limbs (with roller cords, guide loops and suspenders)," to join the new brigade, determined to have another crack at this foe who dares to dictate to Great Britain !

Thanks to the Ministry of Pensions, and to Dr. Kelham and his colleagues and the Staff of Queen Mary's Hospital, the valuable experience gained at that unique institution has been made available to the public in the form of a well-illustrated book.

D. C. M.

**SURGICAL DIAGNOSIS.** By Stephen Power, M.S., F.R.C.S. Bristol : John Wright and Sons, Ltd. 1939. Pp. 228. Illustrations 51, Plates 15. Price 12s. 6d.

This is essentially a brief, but pre-eminently practical review of the diagnosis of most of the conditions of a surgical nature commonly met with in everyday surgical practice.

The text is illustrated by many useful and intriguing line drawings, and the 15 X-ray films are clearly reproduced.

A most useful ready reference, avoiding the more abstruse differential diagnostic points, and written in a clear and practical way, this is another example of excellent publication.

D. C. M.

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## Correspondence.

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### CHARTERHOUSE RHEUMATISM CLINIC.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—It is probable that many cases of fibrositis and muscular rheumatism will develop amongst the soldiers, for which provision of adequate physiotherapy might be difficult. At the Charterhouse Rheumatism Clinic it has been found that such cases respond very readily to a few injections of stock vaccine. The necessity for physiotherapy is thus avoided.

I am writing to you to say that I have offered, on behalf of the Charterhouse Rheumatism Clinic, to provide vaccine free of charge to any officer of the R.A.M.C. who might wish to treat rheumatic cases on these lines.

Officers desiring to take advantage of this should write to the Secretary of the Charterhouse Rheumatism Clinic, 56-60, Weymouth Street, London, W.1, stating at the same time what experience they have had, if any, in the vaccine technique of this Clinic. If none, full particulars will be sent so as to enable the vaccine to be administered with the success which should attend this form of therapy in early cases.

56-60, *Weymouth Street*,  
W.1.

December 1, 1939.

I am, etc.,  
H. WARREN CROWE,  
*Senior Physician.*

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## Notices.

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### "TABLOID" "THEOBA."

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## THE NATIONAL CENTRAL LIBRARY : HOW IT IS HELPING IN TIME OF WAR.

IN times of peace the British Isles has, in addition to a splendid public library service, a system of library co-operation under which all persons requiring books for any serious purpose are able to obtain them through their local public, university, or other library. The country is divided into a series of regional library systems, each system covering a group of neighbouring counties, and each having a regional bureau at which a union catalogue of the non-fiction books in nearly all the libraries in the area has been, or is being, compiled. The keystone of the national system is the National Central Library which, in addition to being itself a great lending library, is the national centre for the inter-lending of books between one library and another. The system has become so efficient that practically any kind of serious literature can now be obtained on loan. The service is available to every branch of the community, from persons requiring information on the humblest everyday matters to research workers needing highly specialized and technical literature.

In time of war the national library service will not only continue to be of the utmost importance to those who need books for general purposes, but it will also be of greatly increased value to Government departments, organizations, and persons needing special literature in connexion with work of national importance. The National Central Library will naturally give priority to the latter service, as it is recognized that in tracing material for persons doing research on all forms of armaments, chemicals, foodstuffs, medicine, and so on, the Library will be filling a gap, the existence of which was so serious a drawback during the last war. The organization of the National Central Library, with its great union catalogues and other unique bibliographical material, and the access it has to over twenty-one million books in other libraries in the British Isles, places it in an exceptional position to give a service of special value in time of war. Through it, the whole library system throughout the country will be enabled to render truly national service.

Owing to the risk of the destruction of property at the headquarters of the National Central Library in London, all the union catalogues, as well as all other irreplaceable or scarce bibliographical material, have been removed to Hemel Hempstead. The non-bibliographical books are remaining at the London headquarters in Malet Place, W.C.1. All applications for books or bibliographical information should be made through the reader's local library, but correspondence on any other subject should be addressed to the National Central Library at Bourne Lodge, Bourne End, Hemel Hempstead, Herts. In cases of difficulty the Librarian will gladly give information about the source from which books may be obtained on loan.

## EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

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Communications in regard to editorial business should be addressed—"The Editor, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, A.M.D.5, Thames House, No. 3, Millbank, S.W. 1."

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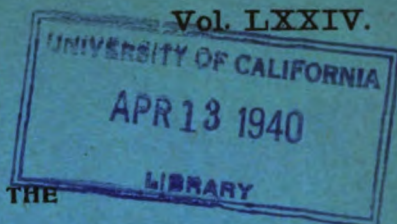
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### CONTENTS

	PAGE
ORIGINAL COMMUNICATIONS.	
A New Portable Hot Air Disinfecting and Drying Machine. By Brevet Lieutenant-Colonel A. E. RICHMOND, <i>O.B.E., R.A.M.C.</i>	121
Foot-gear. By JAMES MENNELL, <i>M.D.</i>	138
The Treatment and Prophylaxis of Superficial Ringworm Infections. By Surgeon Lieutenant-Commander P. K. FRASER, <i>M.D., R.N.</i>	145

#### EDITORIAL.

Trench Foot	154
-------------	-----

#### CLINICAL AND OTHER NOTES.

Two Rare Toxic Manifestations Due to Treatment of Syphilis with Organic Arsenic Preparations. By Lieutenant-Colonel H. G. WINTER, <i>M.C., R.A.M.C.</i>	161
---	-----

	PAGE
New Appliances for the Recovery and Transport of Casualties in Forward Areas Under Fire. By Major ST. CLAIR BARRETT, <i>R.A.M.C., T.A.</i> , and Colonel E. M. COWELL, <i>C.B.E., D.S.O.</i>	166

A Case of Gonorrhoeal Ophthalmia Aborted by Early Treatment. By Lieutenant-Colonel J. BIGGAM, <i>M.C., R.A.M.C.</i>	169
---	-----

#### ECHOES OF THE PAST.

Twenty Years After. By H. SKIPTON STACY, <i>M.D., Ch.M.(Syd.), F.R.A.C.S.</i>	171
CURRENT LITERATURE	176
REVIEWS	181
CORRESPONDENCE	182
NOTICES	160, 182

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#### A NEW PORTABLE HOT AIR DISINFESTING AND DRYING MACHINE.

BY BREVET LIEUTENANT-COLONEL A. E. RICHMOND, *O.B.E.*,  
*Royal Army Medical Corps.*

As a result of a series of experiments carried out at the Royal Army Medical College, Millbank, London, during the past two years, a portable apparatus known as the Millbank Hot Air Disinfestor and Drying Machine has been perfected and is now in production.

In view of the great importance of the provision of adequate disinfestation facilities in the field it is thought that the brief description given of the new machine referred to will be of interest to many readers.

Under existing arrangements each divisional mobile bath unit is provided with one of these machines and four of them are held at the disposal of Corps Headquarters for distribution as circumstances necessitate. They will also be available as required in camps both at bases and on the lines of communication abroad and in training areas at home.

#### I.—GENERAL REMARKS.

The machine has been produced with a view to solving the problem of the satisfactory treatment of clothing, equipment, blankets, etc., under field conditions. It is easily transportable, either by mechanized or by horse- or mule-drawn transport, and is, in addition, easy of erection and capable of being quickly brought into use. It requires no very great technical skill in operation and is able to deal with lice and their eggs in a reasonably

## 122 *A New Portable Hot Air Disinfesting and Drying Machine*

short space of time in a large quantity of materials and is, moreover, capable of quick dismantling and packing for transport. The trained personnel required is one N.C.O. and four men.

As regards destruction of lice and their eggs, the production of a minimum surface temperature of  $70^{\circ}$  C. throughout the whole of the clothing, etc., under treatment in a maximum period of thirty minutes is achieved.

This temperature gradually produced is adequate for the killing of the louse in all its stages, as also of the *Sarcoptes scabiei* and its eggs.

Other objects kept in view in evolving the apparatus have been the attainment of the maximum drying capacity possible, and the keeping down of the bulk and weight of the apparatus to less than 30 cwt.

The general principle of the apparatus comprises the circulation of large quantities of air at very high temperatures through contact chambers in which the materials to be dealt with are suspended.

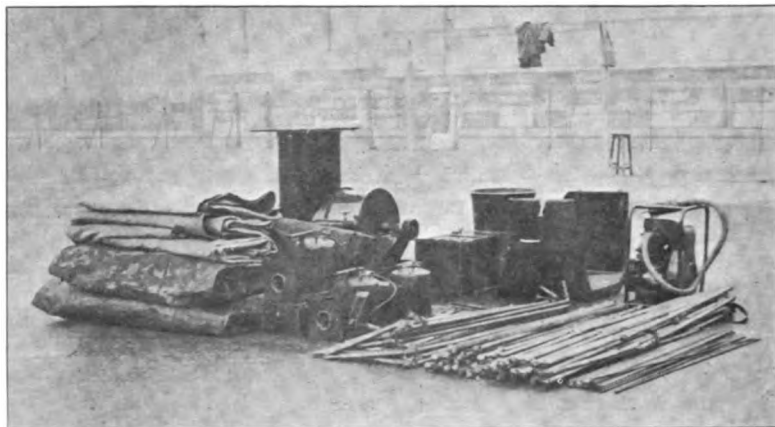


FIG. 1.—Apparatus dismantled and ready for loading on to the lorry.

This is done by means of a powerful fan driven by a small petrol engine which passes the hot air through a patent form of heater.

### II.—DESCRIPTION OF THE APPARATUS.

#### (1) *The Air Heating and Circulating Elements.*

(a) *Petrol Motor.*—This is a 6 h.p. J.A.P. engine of the air-cooled stationary type bolted to but easily removed from a base-plate to which also are bolted the fan and the patent air heater.

The drive between the engine and fan consists of a set of pulleys and V belts.

The engine is fitted with a Burgess silencer complete with flexible exhaust pipe so that the silencer can be placed on the ground in any position to allow of the exhaust gas escaping down wind.

(b) *Fan*.—This is of the centrifugal type and is capable of handling 3,500 cubic feet of air a minute.



FIG. 2.—Air heating and circulating apparatus (lateral view) : 1, Suction duct ; 2, delivery duct ; 3, fresh-air valve ; 4, engine and cover.

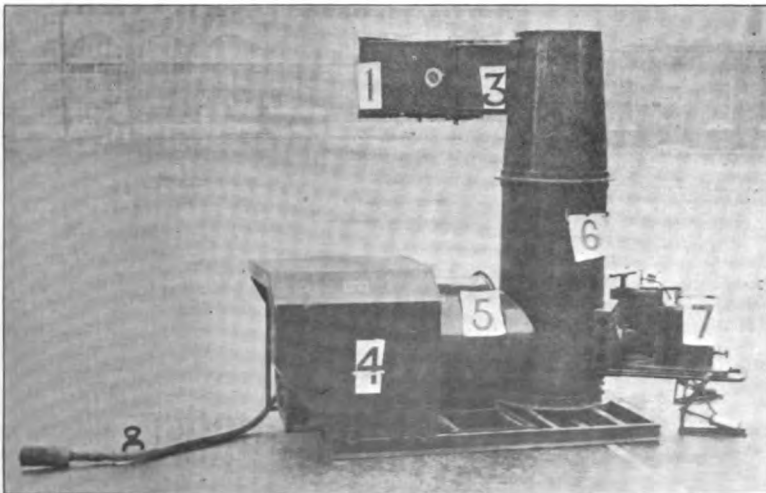


FIG. 3.—Air-heating and circulating apparatus (back view) : 1, Suction duct ; 3, fresh-air valve ; 4, engine cover ; 5, fan ; 6, air heater ; 7, Hydra stove ; 8, silencer with flexible exhaust.

The fan withdraws air via the upper duct of the contact chamber which is in use at the time (or from the outer air when an open circulation is employed) and, taking it through the air heater, propels the hot air into the chamber by the lower duct shown in the illustrations.

The number of air changes per minute in the contact chamber with the fan working at maximum speed is about eight.

(c) *Mixing Chamber (Air Heater).*—A diagram of this is given and reference to it shows that it is provided with an internal combustion chamber

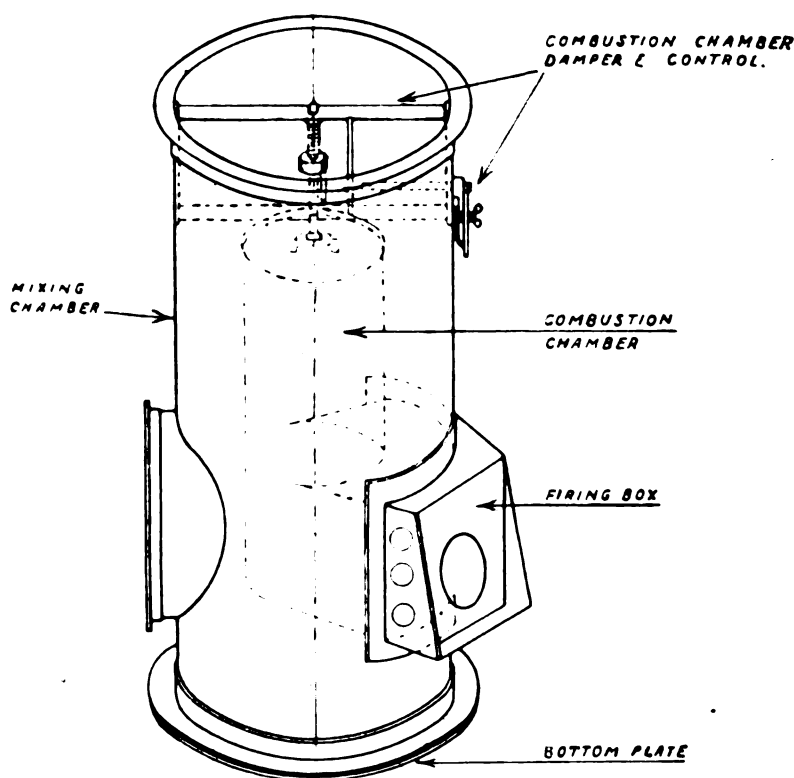


FIG. 4.—The air heater.

and flue both constructed of staybrite steel or some similar metal capable of withstanding oxidization when subjected to very high temperatures.

The remainder of the mixing chamber and ducts are made of gauge 16 sheet steel.

The flue of the combustion chamber is provided with a plate-type damper which is controlled by a lever passing through the side of the chamber.

This chamber, too, is of sufficient size to enable the use of two burners of the type described later.

(d) *Suction (Outlet) Duct.*—This has suitable flanges to allow of its easy

attachment to the mixing chamber as well as to the canvas ducts forming the air outlets from the contact chambers.

It is furnished with a valve and lever and a locking arrangement for fixing the valve in the required position.

The object of this valve is to permit the suction of air from one or other of the two contact chambers according to which is in use.

The duct is fitted also with a second valve which in one position allows of complete recirculation of air between the heating apparatus and either contact chamber.

In the other position it permits all, or as much as is desirable, of the air passing to the mixing chamber to be drawn from the atmosphere.

(e) *Delivery (Inlet) Duct*.—This, as already stated, is provided with flanges for bolting to the delivery of the fan, and for securing at the other end to the canvas ducts forming the hot-air inlets to the contact chambers.

It has a valve, as described in the case of the suction duct, to permit of the use of either of the two contact chambers as desired.

(f) *Petrol Stoves*.—Two pressure petrol Hydra stoves (Type E), of the same kind as those used with the field cookers, are employed.

Each stove is capable of developing approximately 150,000 British thermal units per hour, the size of jet employed measuring 0.040-inch diameter.

The petrol consumption is approximately 1 gallon per hour per stove.

(g) *Miscellaneous*.—Two dial thermometers of the Rototherm type are provided for insertion in the inlet and outlet ducts, together with a third instrument of this type as a reserve. A long-stemmed (3-feet) Rototherm thermometer is also included for measurement of chamber air temperatures.

A strong metal cover arranged for fixing to the base-plate is available to give protection to the engine and drive, while finally, the necessary spare parts to allow of any minor replacements which may become necessary in the field are issued with the apparatus.

A reserve petrol stove is also provided.

## (2) *Contact Chambers.*

There are two of these with each heating apparatus. This arrangement allows materials in one chamber to be under treatment while the other is being emptied and refilled.

The supporting framework of each contact chamber is of tubular steel, and when packed for transport takes up very little space.

It can be rapidly erected and dismantled, and no bolts, nuts, or tools of any description are required.

An inner covering of a double layer of thick canvas is supported by the framework and completely envelops it, converting it into a rectangular canvas-lined container 12 feet long by 6 feet broad by 6 feet high, with a capacity of 432 cubic feet.

To one end of this inner covering are sewn the canvas inlet and outlet



ducts, while, in addition, there is an outlet to the atmosphere which is closed by a laced flap when not required.

Sewn to the edges of the opening into the chamber of the inlet duct is an internal distributing duct 11 feet 9 inches long and 5 feet 6 inches broad. The upper surface of this is provided with a large number of eyelets through which the hot air passes and is evenly distributed through the contact chamber.

When not in use, this duct lies flat or can be rolled up.

When in use, with the hot air passing through, it becomes inflated and assumes a mattress-like form of a depth of some 4 to 6 inches.

At the other end of the canvas chamber there is a flap which can be lifted or lowered as necessary, and which, when laced to the sides of the inner covering, effectively seals the door end of the chamber.

Each chamber rests on a thick canvas floor tarpaulin which in addition to acting in this capacity has flaps at each side which are carried up outside and over the inner canvas covering and are laced to a valance of the latter running along its sides about 1 foot from the top.

There is a similar type of flap attached to the edge of the floor tarpaulin at the door end which, when the chamber is to be closed, is laced to a valance running across the door flap of the inner covering about 1 foot from the top.

The two contact chambers formed in this way can be easily lifted by three or four men and are placed as close alongside each other as possible.

In order to assist insulation, blankets are laid over the flat top of each contact chamber, on the floor, and draped down the outer sides. For this purpose, with each disinfector fifty Army blankets are issued.

A superstructure, also of tubular steel and intended to provide a support for the outer covering now to be described, is then put in position and is of such a nature that the cross-pieces slope up from the top of the outer side of each contact chamber to a ridge pole lying  $1\frac{1}{2}$  feet above the top of the inner edge in each case.

Over the gable roof so formed is placed the roof covering which forms one of the four subdivisions of the outer covering. The other three subdivisions of the latter, which comprise the ends and sides, are then placed in position and are attached to the roof covering by straps and buckles. Closure at the corners is carried out similarly.

This outer covering therefore envelops both contact chambers and gives adequate protection against rain and wind, and also aids insulation.

At one end there are the necessary openings corresponding with the inlet and outlet ducts already described, and with the openings to the atmosphere in the inner containers previously mentioned.

At the other end the outer covering is provided with two flaps which correspond to the two door-ends of the contact chambers, and which can be opened or closed by means of straps and buckles.

Finally, and passing through all layers of the contact chambers on the

outer sides, are four port-holes protected by flaps in order to eliminate leakage of hot air from them as far as possible, through any of which an arm can be inserted in order to ascertain how drying is proceeding.

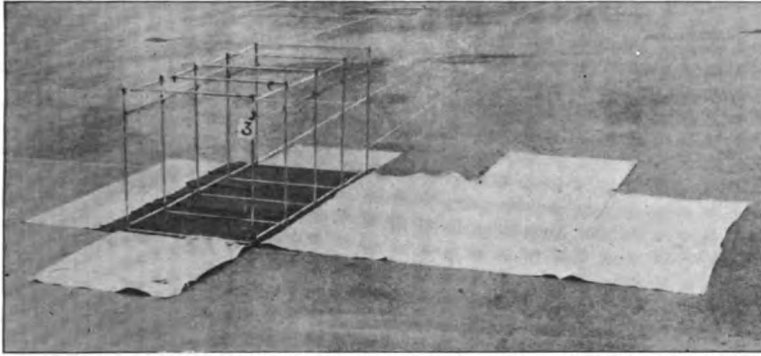


FIG. 5.—The tubular steel framework moved on to its inner canvas cover and floor tarpaulin. Note the blanket insulation on the floor.

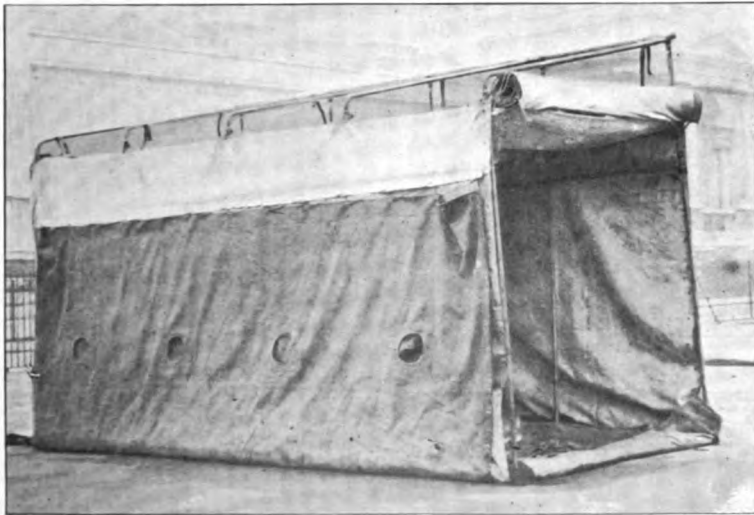


FIG. 6.—One contact chamber complete with the roof superstructure.

### (3) *Supporting Rods for Clothing and Equipment and Rod Carriers.*

Clothing, blankets, equipment, etc., for disinfestation or drying are supported on rods as described later. 210 such rods are provided with each apparatus.

In order to assist rapidity in loading or unloading, metal carriers which will hold a maximum of 20 rods per pair are provided, together with one

pair of tripods fitted with special racks for holding these carriers. By this means, loading of the rods with clothing, etc., and of the carriers with the rods, can be easily carried out outside the contact chambers. The carriers, after being loaded, are then taken in turn into the contact chamber.

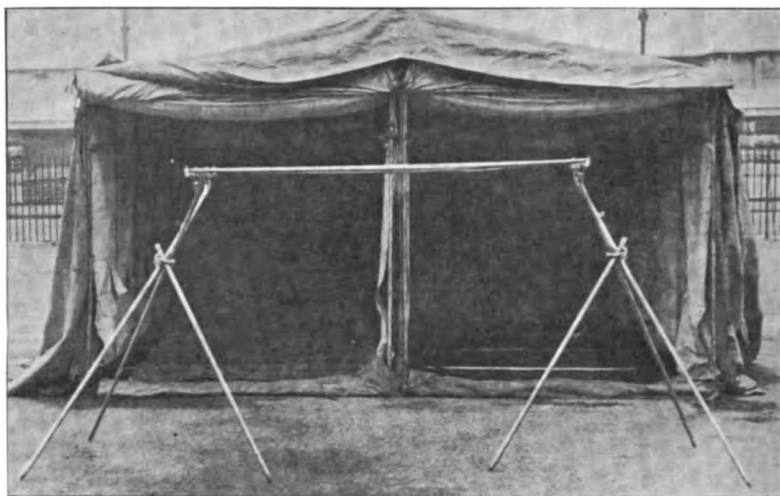


FIG. 7.—The two contact chambers fitted with the outer tarpaulin. Note the loading tripods and rod racks in foreground.



FIG. 8.—The complete apparatus. Note the silencer laid in a small tub of water, which acts as an additional silencer.

Along each side of each contact chamber, 9 inches from the top, is fixed a long grooved iron channel along which the carriers holding the rods are slid into place.

By the above means, even distribution of the materials to be treated throughout the contact chamber is obtained.

### III.—PROCEDURE TO DISINFEST OR DRY CLOTHING, GREATCOATS, EQUIPMENT, BLANKETS, ETC.

The materials to be dealt with are suspended on rods.

The number of rods employed and the maximum amount of materials of various types which may be dealt with at one time are indicated in the following table :—

Materials	No. of rods	Maximum No. of articles	No. of articles per rod
Blankets only .. ..	100	100	1
Greatcoats only .. ..	30	100	3 to 4
*Suits of outer clothing only .. ..	30	100	3 to 4 suits
Sets of equipment only .. ..	30	120	4 sets
Complete sets of *outer clothing, greatcoats, and equipment .. ..	30	30	1 set

\*With accessories, i.e. cap, cap comforter, cardigan, gloves, or mittens, gaiters or puttees.

(Note.—When varying combinations of the different types of materials are to be dealt with, the above table will afford a guide as to the number of rods to be used.)

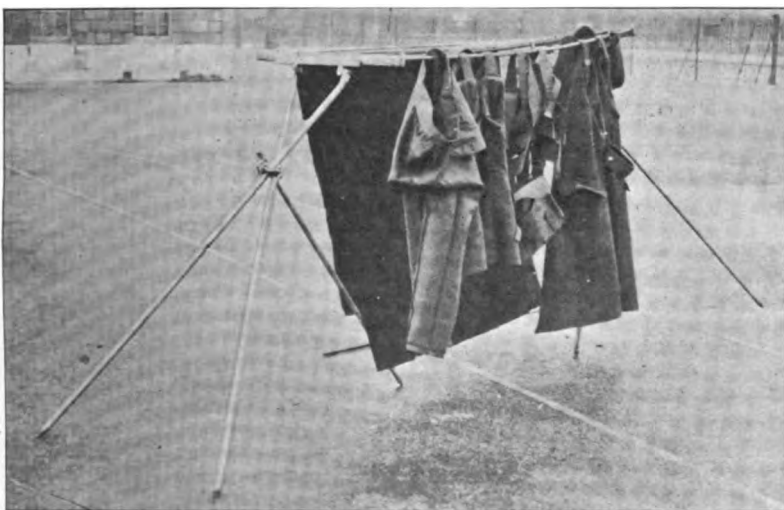


FIG. 9.—The loading tripods and rods showing methods of suspension of materials.

Each pair of rod carriers is provided with notches which accommodate 20 rods per pair, and there are five such pairs of carriers per contact chamber.

When the full complement of rods is not being used, the number employed per pair of carriers is reduced accordingly.

The following methods of suspension of articles on the rods are used :—

For purposes of disinfestation, or disinfestation combined with drying, blankets are hung lengthways over the rods—one per rod.

In the case of clothing, the rods are passed through the fastened shoulder lapels of the greatcoats, blouses, or tunics, or as regards the trousers of the battle suits through the straps at the ankle.

In the case of ordinary trousers, the top button of the fly is fastened over the rod.

Other smaller articles of clothing are suspended from the rods or equipment or outer clothing as convenient.

In addition, it is necessary that sleeves and pocket linings should be turned inside out, and in the case of pockets without linings, the flaps undone and tucked loosely into the pockets.

Trouser legs also should be turned inside out.

It will be realized that variations of the above methods of suspension may be necessary in certain circumstances and will be dictated by common sense.

The essential points are to obtain as much spreading out and as adequate and even a spacing between all articles as possible and to get maximum contact with the hot air of those parts of the clothing, etc., most likely to be infested.

For purposes of drying only, it is unnecessary to turn sleeves, pocket linings and trouser legs inside out.

It will be appreciated also, as regards drying, that with really wet clothing, steps should first be taken before suspending it on the rods to wring out as much surplus water as possible.

#### *The Filling of the Contact Chamber.*

(1) If not already done, the two loading tripods are erected conveniently close to the filling end of the chamber. Pairs of carriers are then placed in turn on the supports of the tripods provided for the purpose and each pair given its complement of rods complete with articles to be treated.

(2) Each pair of carriers, as soon as loaded, is placed on the channel guides and slid along the latter into position in the contact chamber.

(3) All five pairs of carriers having been loaded into the chamber in this way, care is taken to ensure that there is a minimum space of 6 inches between the bottom edges of the articles to be treated and the top surface of the distributing duct when inflated, and that the clothing or other articles have been hung as evenly as possible. Two insulating blankets are now hung across the door end of the chamber.

(4) Closing of the chamber is completed by bringing down the door flap of the inner container and lacing it by the cord and eyelets provided to the corresponding side edges of the same container. In a similar way the door flap of the floor tarpaulin is taken up and laced by its top edge to the valance sewn across the outer surface of the door flap of the inner container, and by its sides to the corresponding side edges of its side flaps. The door flap of the outer tarpaulin is finally brought across and fastened in position by straps and buckles.

#### *The Management of the Heating Apparatus.*

Two trained men are required for this purpose, the duty of one being to deal with the engine and fan, to supervise the inlet and outlet temperatures

and to ensure correct position of the valves, and of the other to supervise the two Hydra stoves employed, and the damper of the combustion and mixing cylinder.

Points of importance in regard to the general management of the heating apparatus are as follows :—

(1) *Stoves*.—These should be run at an initial pressure of 55 pounds per square inch, but as soon as the maximum permissible inlet temperature is reached this pressure should be reduced as necessary to a pressure as low as 40 pounds. Reduction of pressure in this way diminishes the heat produced and saves petrol.

On no account should attempts be made to control temperatures by cutting down the petrol by means of partially closing the burner control valve. This should always be fully open when in use.

*It is important that the stove when burning should not be placed or left in position in the combustion chamber unless the fan is operating.* Otherwise, unnecessary damage may be caused to the metal work of the combustion and mixing cylinder.

The only risk of material importance is that of an explosion due to the stoves being extinguished for any reason and explosive fumes circulating and becoming re-ignited.

The factors operating in this connexion are indicated below :—

(a) The momentary choking of a jet causing extinction of the flame followed possibly by the release of explosive fumes. This has not been met with in a prolonged experience of the use of these stoves, and should it occur would not be of great moment as the second stove would immediately ignite the fumes and thereby dispose of the possibility of their circulating unignited through the apparatus.

(b) Extinction of the flame of one or both stoves by the down draught produced by the fan blowing directly on to the flame. This risk is countered by the provision of a damper adjustable within safety limits which has already been described and which prevents such a happening.

(c) Extinction of the flame owing to the introduction of the burner into the combustion chamber with the fan at full speed owing to the excessive up-draught created in the combustion chamber and cone and the drawing-up of the flame off the burner.

These difficulties are easily met by attention to the following points :—

(a) The personnel employed in working this apparatus must be warned *to keep constant watch on the stove and to remove an extinguished stove immediately from the combustion chamber.*

(b) The burner ring should be allowed to get red-hot before introduction of the burner into the combustion chamber. This ensures adequate vaporising of the petrol and there is less risk of extinction of the flame.

(c) The burners should not be introduced into the combustion chamber with the engine working at more than half maximum speed. It may, if necessary, be speeded up immediately after the burners have been introduced.

## 132 *A New Portable Hot Air Disinfesting and Drying Machine*

(d) The damper should be suitably adjusted as described below.

(2) *Motor and Fan.*—The speed of the fan is directly dependent on that of the motor.

The engine should be run at approximately half to three-quarters the maximum speed, as sufficient air circulation will thereby be obtained ; moreover, excessive wear and tear will be avoided.

It will be appreciated, though, that variations in speed may be permissible, and experience may prove that better results are obtainable under certain circumstances with increased fan (and engine) speeds.

The following table gives approximate information as to the capacity of the fan in relation to engine speeds :—

Speed of Engine	Equivalent speed of Fan	Equivalent volume of Air handled
Half speed	1,250 revolutions per minute	1,750 cubic feet per minute
Three-quarter speed	1,900 revolutions per minute	2,600 cubic feet per minute
Full speed	2,500 revolutions per minute	3,500 cubic feet per minute

(3) *Combustion and Mixing Cylinder.*—The only precaution to be taken here is to ensure that the damper over the top of the inner combustion flue is adjusted to the correct position. This is easily gauged and should be such that there is just no blowing back of the flame in the combustion chamber, or in other words, so that with a slight lowering of the damper blowing back of the flame begins to show itself.

It will be found that under all normal circumstances the correct position of the damper is fully open.

(4) *Valves.*—The greatest care must be taken that the valves are adjusted in the correct position depending on which contact chamber is to be treated.

Further details in this connexion are given later.

### DISINFESTATION AND DRYING.

#### A.—*Temperature Supervision and Control.*

*The Inlet Temperature.*—This should not be allowed to exceed 150° C. when dry or practically dry materials are being disinfested.

With moist materials for which drying or drying coupled with disinfestation are required, the maximum inlet temperature permissible is 170° C.

Using these maximum temperatures, there is a large margin of safety as regards scorching.

The control of the inlet temperature may be effected in the following ways :—

(1) Reduction of the source of heat by reducing the pressure at which the stoves are worked ; (2) increasing the speed of the engine and thereby that of the fan, which is equivalent to passing more air more rapidly through the heating apparatus ; (3) opening or partially opening the fresh-air valve on the suction duct and taking in as much outside air as is necessary to keep the inlet temperature at the correct height.

The employment of (1) is obviously the most economical and is normally

used. (2) Is the method of choice when more rapid drying or disinfestation is required than is possible with reliance on (1) only, and will result in more hot air being circulated at the maximum temperature which will be as efficient as less air at greater temperatures. (3) Is relied on in an emergency as immediate reduction of the inlet temperature is effected to a degree, dependent upon the extent to which the valve is opened. It has, however, often to be employed in addition to (1) or to (1) and (2) as these measures may not be successful in reducing the temperature sufficiently.

*The Outlet Temperature.*—This depends on many factors and does not require to be controlled. Supervision of it, however, is required as the readings, considered in conjunction with the inlet temperatures, give evidence of the adequate performance of the apparatus as a whole.

In general, it may be said that the inlet temperatures are a more delicate indication of the functioning of the air-heating apparatus, and the outlet temperatures of the progress of the heating up of the materials in the contact chambers. The differences between the inlet and outlet temperatures are also valuable in this respect. Chamber air temperatures may be measured approximately by the long-stemmed Rototherm thermometer supplied, but as already indicated, reliance is placed practically entirely on inlet and outlet temperatures as the means of estimating that disinfestation is adequately performed.

Greater details in connexion with inlet and outlet temperatures are therefore required and are given later.

#### B.—*Disinfestation of Dry or Practically Dry Materials.*

With the contact chamber full of articles according to the scale already given, the inlet temperature should reach  $150^{\circ}\text{C}$ . in a maximum of fifteen minutes, and the outlet temperature should *gradually* reach a minimum of  $118^{\circ}\text{C}$ . in thirty minutes.

The above having been attained, disinfestation (i.e. production of  $70^{\circ}\text{C}$ . throughout the surfaces of the materials being dealt with, including pockets, crevices, and the like) will have been completed at the end of twenty minutes, by which time the outlet temperature will have reached a minimum of  $107^{\circ}\text{C}$ .

Treatment of the contents of the chamber for twenty minutes is therefore normally sufficient. Moreover, in very cold weather or with slightly damp materials, disinfestation may still be achieved in that time owing to the reserve of heat available and the practicability of getting it into the chamber by increasing the engine speed (i.e. air turnover), while still keeping the inlet temperature to the maximum of  $150^{\circ}\text{C}$ . allowed.

As, however, clothing, blankets and the like to be treated may often contain a fair degree of moisture, it is considered better to allow thirty minutes' contact as a routine until full experience with the apparatus in the field shows the extent to which, and when, this period may be reduced.



*C.—Drying of Wet Materials.*

This may be accomplished in three different ways :—

(a) With a completely open circulation. In this case the fresh-air valve on the outlet duct from the chamber to the mixing cylinder is opened, as also the chamber vent to the atmosphere. The ordinary outlet valve from the chamber is closed. This is equivalent to the circulation through the materials of comparatively dry air at rather low temperatures. (b) With a closed circulation as for disinfestation, i.e. the circulation of very hot but humid air, the steam and vapour escaping through the various crevices that inevitably exist with the soft coverings used. (c) As in (b), but with the chamber vent to the air open, i.e. a partially closed circulation and the passing of air over the materials at rather lower temperatures than in (b), but containing less moisture.

Trial has proved that method (b) is the best one to adopt with the portable apparatus, but in the event of a sealed contact chamber being used, as may at times be the case with a fixed plant, method (c) must be employed as, otherwise, there would be no escape for the vapour and steam.

In any case it is imperative that at the end of the period of contact of the materials being treated with the hot air, the fresh-air valve on the inlet should be opened, as also the vent in the contact chamber, and the chamber be flushed through with warm dry air for a few minutes to remove the moisture-laden air from which otherwise moisture would condense in the materials.

The capacity of the apparatus for drying purposes is indicated in the following table in which other information is also given. The figures given should be looked upon as averages, and minor variations must be expected in practice.

Articles dealt with	Water content	Time of contact	Inlet temperature	Outlet temperature	Water evaporated
100 suits	10 oz. per suit, i.e. 6½ galls. total	30 mins.	170° C. in 20 mins.	102° C. after 30 mins.	6 galls., i.e. suits practically dry
100 suits	2 lb. per suit, i.e. 20 galls.	60 mins.	170° C. in 20 mins.	112° C. after 30 mins.	17 galls., i.e. 3 oz. per suit left
100 blankets	2 lb. 6 oz. per blanket, i.e. 24 galls.	60 mins.	170° C. in 20 mins.	105° C.	16 galls., i.e. 12 oz. per blanket left

Stated briefly, the drying capacity of the machine is equivalent to the evaporation of about 16 gallons of water an hour from full loads of clothing or blankets, and about 6 gallons in half an hour.

This proportionately smaller figure for the shorter period is due to the fact that the preliminary heating-up time forms a much larger proportion of the whole than is the case with the longer contact time.

Put in another way, clothing containing about as much water as it would take up *after* exposure to a moderately heavy shower of rain for a few minutes will be dried in thirty minutes. Moderately wet blankets or clothing, however, will require a minimum of one hour's contact.

(*Note*.—The wettest clothing or blankets to be dealt with, i.e. materials in the first instance absolutely sodden but wrung out before suspension in the contact chamber, would contain water in approximate amounts, as follows, depending on the efficiency of the wringing.

Blankets	..	..	6 to 7 lb. per blanket
Suits	..	..	2½ to 4 lb. per suit

Drying of these could clearly not be effected in less than three to four hours in the case of blankets, and about one and a half to two hours in the case of suits.)

It should be observed that after some forty minutes' contact of wet materials with the hot air, there will be a tendency for the outlet temperature to remain stationary and even to drop a little, a similar state of affairs developing as regards the surface temperature of the articles being treated.

This is due to the conversion of water into steam in large amounts and to the fact that much of the incoming heat is taken up in order to effect this conversion.

Finally, it should be remembered that with a chamber-load of materials containing varying amounts of water, it is of advantage to place the wettest articles at the duct end. If this is done, the chamber may be opened up at intervals and the dry materials removed from the middle and door end and replaced by others.

The progress of drying may be ascertained by inserting an arm through one or other of the four port-holes provided and feeling the materials.

#### D.—*Combined Drying and Disinfestation.*

This represents the most difficult problem of all, as the minimum surface temperature of the materials reached is below the 70° C. attained in ordinary disinfestation.

The problem is also an involved one as, in respect of the effects upon lice and their eggs, we are dealing with three operative factors : (a) In the very early stages, hot moist air alone ; (b) later, in addition to (a), some steam and some superheated steam, both of which are rapidly destructive of lice and their eggs and in many parts of the contact chamber will exert this effect.

On the other hand, the presence of some steam and some superheated steam in the whole of the contact chamber cannot be guaranteed, and where they do not come into contact with the lice and their eggs, hot moist air must be the operative agent.

In regard to this, painting the worst picture possible and one only representative of a state of affairs existing in an extremely limited portion of the contact chamber, lice and their eggs are in the course of a sixty-minute drying period subjected to moist hot air at 50° to 55° C. for at least twenty minutes, and in the thirty-minute contact period employed for slightly wet clothing to the same temperature for some seventeen minutes.

These minimum temperatures are attained in the most inaccessible crevices and similar places in the clothing under treatment.

It is reasonable to suppose that these temperatures for the periods stated will kill most lice and their eggs. On the other hand, they are close to the "border-line" limits, and it will be appreciated that the most careful inspection of wet clothing, etc., treated should be carried out at the end of the contact time to ensure that lice and their eggs have been destroyed and, if necessary, an additional period of contact should be given.

It is pointed out also that in the course of time units operating these hot-air disinfestors in circumstances in which lice and their eggs are plentiful will be able, as the result of practical experience in the field, to throw much further light on this aspect of louse destruction.

As regards scabies, the above temperatures are not sufficient to kill either the mite or its eggs, and to deal with these drying followed by ordinary hot-air disinfestation is necessary.

#### EMPTYING THE CONTACT CHAMBERS.

The door flaps of the outer tarpaulin, inner canvas container, and floor tarpaulin, are undone and rolled up.

The door flap of the floor tarpaulin is rolled up to lie on the ground at the entrance to the contact chamber, care being taken to roll it up as tightly as possible, so that it is unlikely to sustain more than a minimum amount of damage from being trampled on.

The operation having been completed, the treated articles are removed by lifting out the carriers in the same way as was described in connexion with the filling of the contact chambers.

This having been done, the chamber is ready for refilling.

#### CONCLUSION.

A new form of hot-air disinfestor and drying machine is described which is of a portable type. It will be realized that the principle used is applicable also to large-scale disinfestation and drying at fixed centres, and that it is merely a question of increasing engine and fan power and the number or size of the stoves when larger quantities of materials than those catered for in the portable model have to be dealt with.

At fixed centres naturally the portable canvas containers are not required, and simply constructed timber and corrugated iron chambers will meet the case and be less expensive.

Finally, the author wishes to point out that in the course of the experiments which have resulted in the evolution of this machine, much help has been received from many sources. Major-General W. Brooke Purdon, D.S.O., O.B.E., M.C., K.H.S., both as Professor of Hygiene at the R.A.M. College and later as Commandant, has been consistently encouraging and helpful. Colonel D. T. Richardson, M.C., who succeeded him in the professorship,

did much work in connexion with the apparatus and made a number of suggestions, many of which were ultimately embodied in it.

5662849 Qm.-Sjt. F. E. Parsons, R.A.M.C., is deserving of much praise for the consistent and loyal assistance he has given throughout, while we were most fortunate in having the help of No. 5 Mobile Battery Unit under Lieut. L. Gedge for some weeks in the later stages of the work. Throughout, also, a number of N.C.O.s and men devoted much time and labour to the actual working of the apparatus and are deserving of many thanks.

Much of the detailed technical work required expert assistance from engineers and others, and in this connexion Mr. W. R. B. Cross, of Messrs. G. N. Haden and Sons, Ltd., has especially earned our gratitude for the tremendous amount of assistance he has given us over a long period of time, while Mr. Leonard Motley, of Hydran Products, Ltd., was always ready to come to our aid when circumstances necessitated it in spite of many calls on his time in other directions.

Finally the author would stress the fact that any suggestions as to modifications of the apparatus which extensive practical work in the field may indicate as necessary will be generally welcomed and be given every consideration.

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FOOT-GEAR.<sup>1</sup>

BY JAMES MENNELL, M.D.

WHEN we look at the windows of any ordinary shoe shop of even moderate size we find them labelled "Ladies and Children" on one side and "Gents" on the other. Now why should this be so? "Children" and "Adults" one could understand, but "Ladies" and "Children" together, "Ladies" and "Gents" contrasted and divorced from one another can have no scientific justification. A human foot is a human foot—and one of the most wonderful works of the Almighty at that—be it male or female, nor do the marvels of its design include one pattern for men and another for women. Indeed we need a micrometer screw to distinguish between some of the bones of the skeleton of the male and female foot, while most of them are quite indistinguishable. There can therefore be no particle of scientific justification for the divorce of the two departments that deal with foot-gear. In other words we are the slaves of fashion and of the shoe manufacturer.

In the windows of one side of the shops we see shoes with relatively high heels and pointed toes, in the other we see them with relatively low heels and square toes. In the section of the first reserved for children we find a reversion to the low heel square toe variety again, but of different type. One can only meditate sadly on the changes that are supposed to take place in the human foot during adolescence to justify the change—possibly in a few months—from the children's type of foot-gear to one of the other types.

*The Sole.*—Few people will deny that the heel is narrower than the fore-part of the foot at the level of the heads of the metatarsals, and it is perfectly plain therefore that the general contour of any shoe to be accurate must be roughly triangular when seen from above, the angle at the heel being somewhat rounded (fig. 1). It is not by any means always found that even this elementary law of divergence of these lines is fulfilled adequately and the divergence of the two side lines of the shoe from the centre line of the foot is one that should receive far more attention than is apparently given to it.

The variation in shape and manufacture can easily be tested by placing a straight line between the centre of the heel and the forepart of the shoe running along the middle of the waist. In the tracing of the ordinary human foot this centre line usually passes through about the space between the second and the middle toe, but in many shoes that are made it is quite easy to establish that the design of the last is such that this line passes much too obliquely one way or the other, which means that there must be a very forcible strain upon the joints of the fore-part of the foot tending to swing it round away from the side which encounters pressure. The point where most of this particular pressure is felt is over the head of the first metatarsal

<sup>1</sup> Reprinted by kind permission from the *Proceedings of the Royal Society of Medicine*, vol. xxxiii, p. 105 (Section of Physical Medicine, p. 1).

on the inner side or the fifth on the outer. In choosing a shoe for a normal foot it is therefore wise to select one that has been built upon a last which gives the appearance, when viewed from the sole, of being thrown well in to the inner side at this point, provided the outer side is not thrown inwards to match (fig. 2).

We now come to the consideration of what should be done with the part of the shoe that concerns the foot in front of the metatarsal heads. We must remember in the first place that the laws of physics apply as much in the fitting of a shoe as in any other branch of life. When we raise the heel from the ground the sole of the shoe must of necessity assume a curve, and if the heel of the shoe remains in contact with the heel of the individual, the fore-part of the foot must of necessity slip forward on the surface of the sole (fig. 3). If it did not do so we should have in action the "three-ply system", and as you know this simply means that three very flexible pieces of wood when bound together become relatively rigid. The allowance that should be made for this sliding forwards is two boot sizes; this may

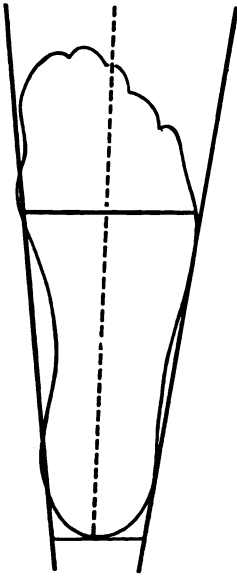


FIG. 1.—To show how the lines joining the sides of the heels to the sides of the metatarsal heads converge towards the heel. Note that although the tracing shows the contour of a foot that is fully serviceable and free from symptoms, it shows nevertheless signs of deformity due to inadequate foot-gear in the cramping of the big toe outwards and of the little toe inwards.

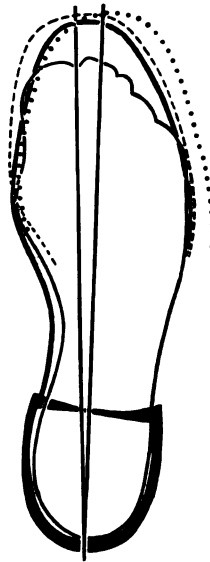


FIG. 2.—Tracings of three welts and the foot for which the shoes are provided. The firm lines show the outline of a plain walking shoe, the broken line that of a (supposedly) similar shoe, and the dotted line that of a golf shoe. The broken line shows the only good fitting. Note the swing away from the centre line of inner side of this shoe and compare it with that of the dotted line. The latter is a far larger shoe but it holds the whole foot in a faulty position.

sound excessive, but in practice it is no more than is essential.<sup>1</sup> Having made this allowance it is quite immaterial what happens beyond it, and the front of the shoe beyond the extreme limit of the essential space is a matter of indifference. Any shape is permissible provided always that the inner side of the shoe does not begin

<sup>1</sup> A boot-size in this country is  $\frac{1}{2}$  in.

to slope outwards until the front of the big toe is reached, and that any slope which is given on the outer side does not detract from the two boot-sizes which are left for the sliding forward of the little toe on the sole when it bends. There should therefore be no quarrel between the human foot and the pointed shoe, the only thing that matters is where the slopes of the point take place (fig. 4).

*The Heel.*—Now we must return to the question of the heel and whether the relatively high heel in the women's department, or the low heel of the men's department is the right and proper one. At first sight the temptation is to condemn the one and laud the other, but this simply ignores the one consideration

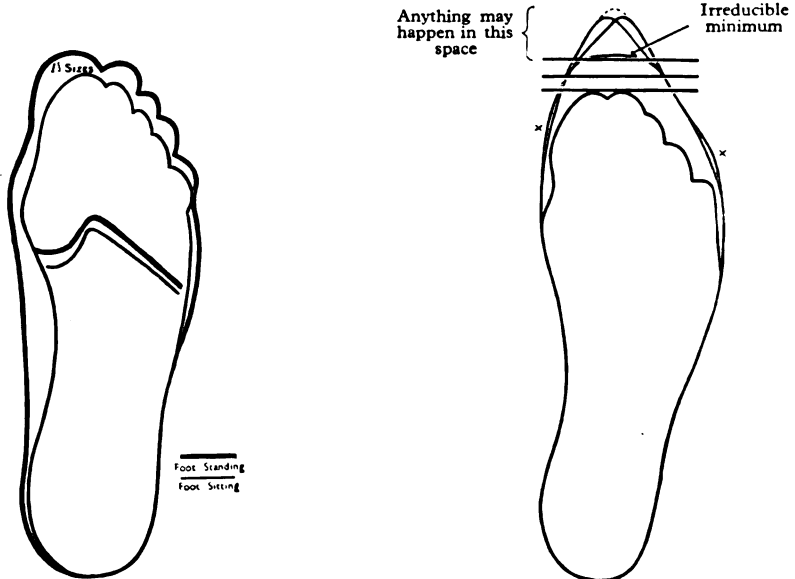


FIG. 3.—Sketch of a foot sitting and standing, showing outline of the back of the metatarsal heads. Note also increase of breadth. This foot is less deformed by foot-gear than that shown in fig. 1 on the outer side, but the big toe still shows signs of pressure. When the heel is raised the front of the toe shoots forwards on the sole to at least the extent of another two sizes— $\frac{2}{3}$  of an inch.

FIG. 4.—To show how a point may be added to an otherwise perfect shoe merely by increase of length. The only disadvantage is the liability to crease rather markedly, and, should the "break" occur at an unfortunate spot—it must occur somewhere—detrimental pressure on the toes may ensue. X X Two points at which the slope commonly begins prematurely. The outer of the two lines shows the correct contour.

on which alone the solution of this much-discussed problem depends. The point in question is nothing more or less than the elasticity of the calf muscles. If there is any relative insufficiency in this elasticity or in the length of the tendo Achillis, then it becomes obvious that, in order to place toe and heel on the ground together and to keep the leg vertical, something has got to stretch. That "something" is of course the structures in the sole of the foot. Bad as no doubt this may be for the intrinsic structures, the stretching forward of the fore-part must of necessity separate the head of the first metatarsal from the back of the internal malleolus round which passes the tendon of the flexor longus hallucis. If the slide forward of

the phalanx of the big toe is great, this muscle or its tendon may lack sufficient elasticity on the one hand or length on the other to allow the distal phalanx to dorsiflex in freedom. Indeed it is almost inevitable that it should be dragged down into the sole of the shoe until, as often happens, a definite hole is dug by the toe on the surface of the sole. Naturally if the sole is thin there is no substance into which the toe can "bed" itself and therefore the tendon becomes more and more strained.

Every normal foot in which the mobility of the joints is not destroyed will elongate to a certain extent when the weight of the body is placed upon it. The extent to which this happens varies considerably, a single boot-size is about the usual, one and a half sizes is not uncommon in a perfectly normal foot (as shown in fig. 3), but anything beyond this should be regarded as pathological.

These considerations lead us therefore to the consideration of the height of the heel required for an individual, be he male or female. The position may be summed up in few words; there are many men who will never know what it is to walk in comfort with less than two and a half inches of elevation at the heel, while some women (particularly those with a hallux rigidus) can never know comfort with any elevation above about three-quarters of an inch. It is utterly wrong therefore for

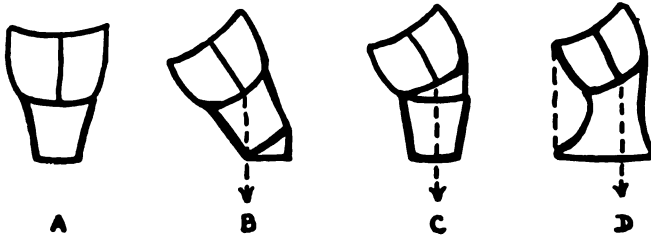


FIG. 5.—To show how the heel should be wedged on the inner side. The figures show the left heel seen from behind: (A) An ordinary heel of the "peg-top" type; (B) To show the effect of placing the wedge near the ground; (C) To show the effect of a corresponding wedge placed near the top of the heel; (D) To show how the lower part of the heel should be thrown out to the outer side to counteract the tendency for the foot to turn over to the outer side.

(From Menzell's "Physical Treatment". With acknowledgment to Messrs. J. & A. Churchill, Ltd.)

men to scoff at the relatively high heel of the shoes in the female shop, but equally many women would be well advised to adopt the relatively low heel in the men's shop. I do not wish this to be taken as being in any way a defence for the extravagantly high heel—i.e. anything above three inches—seen in the women's section, for which there can be no excuse; but for many people, whether male or female, anything up to two and a half inches of elevation may be of vital necessity to comfort.

*Heel-wedges.*—While on the question of heels it might be opportune to say one word about the wedging of a heel though I realize that this is a question of abnormal foot-gear rather than of the normal. In the first place I want to demonstrate to you the contrast between applying the wedge to the bottom of the heel and to the top. A glance at the line drawings will illustrate the point adequately. Under no circumstances should any elevation be made on the inner side unless the heel is thrown out to the outer side at the same time, so as to ensure that the centre of gravity of the body still falls through the centre of the heel of the shoe (fig. 5).



This leads on to the consideration of whether the sole should be wedged on the inner side or not. It seems to me that this prescription is often given without adequate consideration of the mechanical effect that it must produce. The longitudinal arch of the foot on the inner side is formed by the os calcis, the astragalus, scaphoid and first metatarsal. Anything that prevents the head of the first metatarsal from dropping downwards must of necessity tend to flatten the arch. On the other hand, if the heel is wedged upon the inner side and the sole is not raised, the tendency can only be to increase the arch and so relieve the structures in the sole of strain. It seems, therefore, that if we are to use the wedging of the sole aright, we should use it only for those cases in which restoration of mobility is impractical owing to pathological changes within the joints. To apply a sole wedge when we hope to maintain or to restore full mobility is calculated to defeat our main object in treatment.

Returning once more to the heel of the shoe, the "set" at which it is built is often of vital importance. The practice of turning inwards the angle of the heel at the forepart on the inner side is to invite the individual to evert the foot at every step that is taken. No last should ever be chosen in which the angle fails to touch the straight line drawn from the inner side of the heel to the inner side of the sole.

*Fitting.*—We now come to the consideration of the general type of shoe to be chosen by any individual. Attention has already been drawn to the danger of relying for selection of length on the measurement of the foot while sitting. It should be an invariable practice to measure it standing as well, as even if the length of the foot increases by only a length on standing, due allowance should be made. We then add the two boot-sizes necessary for the sliding forward of the front of the foot and finally any addition that may be necessary to allow for the shaping in front. We must add at least half a size to allow for a thin sock and the thickness of the shoe material. The question of breadth is as important as the question of length and again it is necessary to take the breadth standing and sitting. If a tape is placed around the foot at the level of the heads of the metatarsals, and the measurement is taken in the sitting and the standing positions consecutively, it is not at all an uncommon thing to find there is a difference in the two measurements of anything up to three-quarters of an inch (fig. 3). As, however, we have to supply a shoe of a length considerably in excess of the length of the foot, there is no necessity with a normal foot to do the same with regard to breadth. In fact if we do, it often leads to disaster and the shoe chosen is merely a sack. With one exception it is wise to choose from the point of view of breadth a shoe which is a quarter of an inch under the measurement of the breadth of the foot when standing. The one exception is when the patient is the victim of a hallux valgus with a bunion, and in this event the full measurement should be allowed and indeed something extra may be required.

*The Upper.*—We now come to the consideration of the "upper" and here I would remind you not to lay too much faith in the statement of size placed on any shoes in the ladies' department. It is by no means an uncommon event to find a shoe that is labelled five actually measures seven or even more when examined with the shoe-stick. Unfortunately there seems to be no general law in the trade governing the length which a shoe is stated to be in the ladies' department. In the men's

department the variation between the actual and the stated lengths is comparatively insignificant.

The shaping of the "upper" varies enormously according to the different lasts. In American shoes the depth of the front of the toe is usually maintained to the end of the shoe. In the eye of the English manufacturer this is not satisfactory, and it is customary to slope the front part of the shoe down gradually for a considerable distance. It is perfectly plain therefore that this practice must render the front part of a shoe so shallow that the big toe and second toe cannot find their way under this sloping roof. This extra length therefore is sheer waste. It is a particularly sad reflection that this fault is carried to extremes in the children's departments, and, wherever this slope is observed, due allowance must be made for it in estimating the effective length of the shoe.

For most of us a heel elevation of some sort is far more conducive to comfort than no elevation at all. Not long ago an attempt was made to popularize the heel-less shoe; it has not proved to be a success. If, however, we raise the height of the heel at all, the upper surface of the sole of the shoe must of necessity be on an inclined plane, and therefore there will be a tendency for the foot to slip forward down this inclined plane, thus tending to allow the heel of the foot to slip away from the heel of the shoe into the forepart. When this is allowed to take place it is obvious that we must be depriving the patient of the advantage of the extra length for which we have made provision in front. It is essential therefore for comfort that something should be provided to keep the heel back in the heel of the shoe. A narrow strap fixed with a button is totally inadequate and nothing less than two narrow straps fastened with buckles is in any way effective. This of necessity implies the instantaneous condemnation of the court or pump shoe for walking purposes. It is of course a matter of indifference what type of shoe is chosen if it is only to be worn while sitting at the dinner- or bridge-table; we are concerned to-day only with the consideration of foot-gear that will enable us to walk or to stand about without risk of injury. If no adequate provision is made to keep the heel of the foot back in the heel of the shoe, it is obvious that something must prevent the foot from sliding down the slope provided by the inclined plane, and the only thing which can prevent it is the meeting of the front part of the foot with an opposition from the front part of the shoe. This suffices to prevent any forward gliding whatsoever of the toes; but if this happens, i.e. if the toes run up against the front of the shoe, nothing can prevent them from bending at the proximal interphalangeal joints. This will involve dorsiflexion of the proximal phalanges at the metatarso-phalangeal joints and this involves an undue exposure of the heads of the bones in the sole. There is no allowance made in the fore-part of any shoe for flexion to any marked extent of the interphalangeal joints, and, if it occurs unduly, corns over these joints and callosities under the sole are almost inevitable.

Just as we have spoken of the tendency of the English shoemaker to slope the front of the toe from above downwards to an undue extent, so too is the tendency observed to do the same thing on the outer side—again especially in the children's department. It not infrequently happens that a shoe, admirable in every other respect, possesses this fault, with the result that there is no adequate accommodation for the little toe. The further result is that a painful corn in this position is a

frequent occurrence. This fault is also one of the common causes of soft corns between the toes.

Often enough, and particularly when a lace-up shoe is selected, nothing can be found which will allow sufficient control of the heel of the foot in the heel of the shoe. A shallow pad of adhesive felt placed under the tongue will often solve the problem. Another very common fault in the designing of a shoe in this country, though this applies less to the American-made shoe, is the balance between the breadth of the heel at the back and the breadth at the level of the metatarsal heads. Very often the disproportion between the shape of our foot and the shoe that is offered us is absurd; but many of us require a relatively very narrow heel combined with a relatively broad front, a pattern which is often unobtainable from stock.

Finally, of course, when trying to select a pair of shoes it is necessary to measure both feet, as few of us are entirely symmetrical on both sides. In this event it is always wise to select shoes fitted to the larger foot and to make any necessary adjustment for the smaller one by wearing a cork in-sole or sock and a pad behind the supporting strap or tongue. Some retailers are willing to sell one shoe from one box and the other from another box, but it is not a common courtesy. It is also worthy of comment that to wear too short a sock or stocking is just as baneful as to wear too short a shoe.

#### CONCLUSION

The human foot is a perfect miracle of mechanical ingenuity and in the vast majority of people it should be perfect throughout life. With the exception of the victims of congenital abnormality or of gross disease or injury, a painless and perfect foot should be our heritage. Of this heritage we have been deprived by our foot-gear and I cannot help feeling that this evil thing is a reflection on the lack of co-operation between the shoe manufacturers, the anatomist and the medical man. The extent of the evil may be gauged by the extent to which chiropody has become a necessity in our civilized community; and the enormous variety of foot supports and foot-easers (often misappropriately so-called) which are to be found in every town and almost every village throughout the country bear an eloquent testimony to our foolishness in submitting to a tyranny, which is the direct cause of intense suffering in the feet, which is fatal for the all-important maintenance of a correct posture and which, most important of all, leads to irritability and bad temper.

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## THE TREATMENT AND PROPHYLAXIS OF SUPERFICIAL RINGWORM INFECTIONS.

BY SURGEON LIEUTENANT-COMMANDER P. K. FRASER, M.D.

*Royal Navy.*

[In submitting this article for publication in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS I should like it to be taken as an expression of my thanks to the officers and men of the R.A.M.C. who have so kindly helped with the investigation during the last five years. The subject of the paper has already been admirably dealt with in the Journal, but I hope that some of the points raised may be of interest.]

At some time or other since the discovery of mycotic skin lesions, practically every antiseptic has been lauded as a specific cure. This at first glance tends to demonstrate the inefficacy of all; on the other hand, it may also show that any logical treatment under careful and experienced supervision will be successful. Too many practitioners regard the common pathogenic fungi as indestructible, a state of affairs which is not borne out in the laboratory, and this despairing attitude is evident in the casualness of their treatment. It is also not uncommon to find illogical combinations of treatment in the same patient. This is bad policy, and is undoubtedly one of the best methods of producing dermatitis venenata. As in all branches of medicine, it is much better to adhere to a few proved remedies than to rush blindly from one new discovery to another.

Superficial ringworm infections can be permanently cured, provided the disease is regarded as a whole and not as a localized skin infection. It is not enough to eradicate the parasite in the infected area; infected clothes must also be dealt with and, if possible, the source of infection traced. The difficulties in the latter method of approach were pointed out by Weidman (1934) when he said:—

“The hygiene of the problem is so complicated that I doubt whether the difficulty can be met by that route. It is impossible to sterilize all the wearing apparel of the patient; even so, there would still remain the floor coverings in our homes, hotels, shower baths, etc. It seems to me that the real approach to the millennium in the way of treatment is to establish conditions in the intertriginous locations in which the fungi work and mobilize, which will make these locations undesirable to the fungus.”

In some cases it will be impossible to sterilize all the clothes, but it is essential to eradicate the fungus in garments in direct contact with the infected area. In the case of pedal infections it will be necessary, subsequent to treatment, to acidify the interdigital spaces as a prophylactic against reinfection.

## COMMON THERAPEUTIC AGENTS.

*Iodine*.—Of the various medicaments in common use iodine holds pride of place, and its efficacy has been proved *in vivo* and *in vitro*. It is especially useful in tinea cruris and can be applied as the strong or weak tincture or potentiated with potassium iodide as suggested by Strickler (1933). The French use intravenous solutions of iodine, and they recommend them in this way for tinea barbæ and other deep-seated infections (Roxburgh, 1937).

R	Iodine crystals	..	..	2 parts
	Potas. iodide	..	..	3 "
	Aqua destil	..	ad	100 "

Commence with 1 c.c. in 5 c.c. distilled water and increase by 1 c.c. daily until 5 c.c. are injected in 15 c.c. distilled water. Swartz (1935) reports good results from ethyl iodide inhalations.

There is usually some irritation when iodine is applied to the crural region, and if this is not carefully watched an irritant dermatitis may be set up. I have a personal aversion to iodine in any form, and I have seen a great many bad results from over-treatment.

*Salicylic Acid*.—This acid is universally used in mycotic infections, and it is usually combined with benzoic acid as in Whitfield's ointment :—

R	Ac. salicyl.	..	..	15 gr.
	Ac. benzoic	..	..	25 gr.
	Paraf. mol.	..	..	2 dr.
	Ol. cocois. nucis.	..	ad	1 oz.

The ointment is extremely fluid in hot weather and 15 grains of hard paraffin can be added as a stiffening agent. It is somewhat irritating when used near the scrotum, and Whitfield (1934) recommends that it should be used for five days at a time with rest periods of three days. It has the advantage of being colourless. If a paint is preferred the following is useful :—

R	Ac. salicyl.	..	..	1 dr.
	Ac. benzoic.	..	..	1½ oz.
	Acetone	..	..	1 oz.
	Sp. vini meth.	..	ad	4 oz.

The above combinations of salicylic acid sometimes yield disappointing results, and Whitfield says that some of the claims as to their usefulness are extravagant. I always add 1·4 per cent thymol to Whitfield's ointment as suggested by Legge *et al.* (1934). This of course precludes its use round the anus. Parke, Davis and Co. market a salicylic ointment and paint under the name of "Mycozol." An iodide salicylic acid paint has been advocated by Strickler—

R	Iodine crystals	..	..	1·3 parts
	Potas. iodide	..	..	1·9 "
	Ac. salicyl.	..	..	1·9 "
	Ac. boric	..	..	3·8 "
	Alcohol 50 per cent	..	ad	59·1 "

and the originator claims a very low percentage of irritant reactions.

The use of macerating ointments in interdigital pedal infections necessitates frequent curettage, and this should always be done personally. Such a procedure removes dead skin and thoroughly exposes the infected area. It is also desirable, no matter what routine is adopted, to supervise every step in the treatment personally. The results from such personal treatment are much more satisfactory.

In the somewhat rare mycotic pruritis ani, Castellani (1924) recommends a combined salicylic ointment as originated by Deek :—

R	Ac. salicyl.	..	..	4 parts
	Bismuth subnit.	..	..	10 „
	Mercury salicyl.	..	..	4 „
	Ol. eucalypti.	..	..	10 „
	Paraf. liq.	}	..	āā 100 „
	Adeps lani			

From a single personal experience I can best describe this preparation as “very stimulating.”

*Chrysarobin*.—In the course of years chrysarobin has been found to be almost a specific in the treatment of superficial mycotic infections. Indeed it was for the treatment of these conditions that it was first introduced (Norman Walker, 1932). Employed as an ointment—

R	Chrysarobin	..	..	20 gr.
	Adeps lani	}	..	āā 4 dr.
	Paraf. mol.			

it is specific for *tinea cruris*. Inunction should be carried out once a day for four to seven days, according to the reaction of the patient. Some will complain of slight burning from this treatment, but it is surprising how few side effects are produced. It should be followed by a soothing lotion, such as *lotio calaminæ*, to which half a drachm of liquor picis carbonis or 3 per cent ichthyol can be added.

A synthetic derivative of chrysarobin—cignolin, prepared by Bayer, is extremely useful in *tinea pedis*. In ointment form—

R	Cignolin	..	..	10 gr.
	Adeps lani	}	..	āā 4 dr.
	Paraf. mol.			

it should be rubbed into the infected area once daily, taking care that the interdigital spaces are also treated. This treatment can be given to cases of vesicular *tinea*, and I have even applied it to the weeping eczematoid type with success. Seven to fourteen days of daily applications will effect a cure. After inunction the parts should be wrapped in gauze, and the patient should wear loose-fitting shoes or sandals. It may even be necessary to put him to bed in the later stages of the treatment. Cignolin can be applied to the crural type of *tinea*, but there is usually considerable discomfort from this measure.

When using chrysarobin and its derivatives, the irritant effect on the

eyes should be remembered, in addition to their ability to "turn fine linen into purple raiment."

Burgess (1938) recommends a chrysarobin ointment with salicylic acid (Dreuw's ointment):—

R	Ac. salicyl.	..	..	..	6 parts
	Chrysarobin	..	..	..	12 "
	Ol. rusci	..	..	..	12 "
	Lin. sap. mol.	..	..	..	15 "
	Paraf. mol.	..	..	..	60 "

Chrysarobin and cignolin do not act well in paint form.

*Dyes.*—Fuchsin is undoubtedly one of the best antimycotic dyes and it is most commonly employed in the paint form originated by Castellani (1929):—

R	Sat. alcoholic soln. basic-fuchsin	10 c.c.
	5 per cent aq. carbolic acid soln.	100 c.c.
	Filter and add—	
	Boric acid .. ..	1 grm.
	After two hours add—	
	Acetone .. ..	5 c.c.
	Two hours later add—	
	Resorcin .. ..	10 grm.
	Store in a dark coloured bottle.	

It is a non-irritant preparation and is specific for *tinea cruris* and *corporis*. The only drawbacks are its colour and staining properties. Daily application for seven to fourteen days will effect a cure and the method is of importance in the treatment of mycotic infections in women. When applied to the feet it may cause drying and fissuring and it may have to be alternated with an ointment. The results in pedal *tinea* are somewhat disappointing.

Two-per-cent malachite green in spirit is another useful preparation. It has much the same properties as fuchsin paint and is used in the same way for similar conditions.

*Industrial Fungicides.*—Abracide in the form of an emulsion with soap is extremely popular in some quarters. It is usually employed as a 1:100 bath. In dilutions above this the abracide comes out of solution and floats to the surface. In a series of tests conducted by myself it was found that with the 1:100 solution there was considerable irritation, and that in strengths below this the irritation was confined to the junction of the part under treatment with the surface of the lotion. A 1:100 bath has been advocated as a prophylactic, but this is uneconomic and dangerous.

Paranitrophenol as used in the leather trade is completely non-irritating. Used in a 2 per cent aqueous solution twenty minutes daily for a week, it is of value in *tinea pedis* and *manis*. The objectionable yellow colour can be obviated by adding a few drops of hydrochloric acid. On account of the drying effect it should be followed by an ointment. Some workers prefer a 2 per cent solution in spirit.

Mycoten is a favourite remedy in Denmark, and Lomholt (Goldsmith, (1936)) advises the following combination :—

℞	Mycoten	}	..	āā	3 parts
	Ac. salicyl.				
	Paraf. liq.				
	Ung. plumbi ox. (D.P.)		..	60	„

It is frequently employed with a mycoten paint.

*Metallic Fungicides.*—Copper salts in high dilution are lethal to the lower forms of vegetable life, and their use has been logically recommended in mycotic dermatoses. Moloney (1937) reports good results from a 20 per cent solution of dehydrated copper sulphate in pure glycerine. It should be rubbed into the lesion daily for fifteen minutes. Weak solutions of silver nitrate are also useful in the weeping eczematoid type.

*Mycotic Extracts.*—A considerable amount of work has been done on the use of mycotic extracts in ringworm infections, and the results have been universally disappointing. Even in cases with manifest allergic eruptions it is sufficient to treat the primary lesion. Recently Tolmach and Traub (1938) carried out a carefully controlled series of tests with poor results. In the present state of our knowledge these preparations cannot be recommended for general treatment.

*Powders.*—Powders are useful in treatment as an adjuvant to ointments. In weeping cases they cause drying of the discharge, and frequently they are all that is required to effect a cure. Burgess recommends :—

℞	Boric acid	}	..	āā	1 part
	Venetian talc.				
	Kaolin				

Silantox (amorphous silicon dioxide, Silica Gel, Ltd.) is another useful dusting powder. It is best to exclude starch from all powders to be used on the feet. In the presence of moisture and movement it tends to cake and may aggravate itching. As a rule 2 per cent salicylic acid is added to the above preparations. Holmes (1939) claims good results from the following powder which is much used in the U.S. Navy :—

℞	Salicylic acid	..	..	..	5 parts
	Menthol	..	..	..	2 „
	Camphor	..	..	..	8 „
	Boric acid	..	..	..	50 „
	Starch	..	..	..	35 „

If should be rubbed into the affected parts three times a day, but is contra-indicated in the weeping eczematoid type.

*Sterilization of Clothes.*—Whenever possible all garments in contact with the infected area should be boiled. This will include socks, singlets, etc. In the case of boots or leather gloves, they should be placed in a box with 50 c.c. of formalin in an open container and left for twenty-four hours. To save time, the insides of shoes can be swabbed with formalin and left to



air for two days. Insoles should be destroyed and replaced by new ones. It may be mentioned that many of the agents employed in dry cleaning are not fungicidal. Kadisch (1931) advises 1 per cent thymol in spirit for sterilizing clothes, but the method seems unduly expensive. Steam sterilization is satisfactory. Recently a modification of this method has been produced which uses formalin vapour in a partial vacuum and would seem to be ideal.

#### TREATMENT OF *TINEA CRURIS*.

If the affected area is inflamed or weeping, calamine lotion, or ichthyol calamine lotion, should be applied three times a day. Some prefer to use ung. hydrarg. ammon. at the start. Undergarments should be sterilized at the commencement of treatment and regularly thereafter. When the inflammation has subsided, one of the ointments or paints should then be used daily, or twice daily, according to the reaction of the individual. Later, when a cure has been effected, the area should be dusted frequently with a salicylic acid powder.

This routine is also sufficient for *tinea axillaris*.

#### TREATMENT OF *TINEA PEDIS*.

It is essential in all cases of foot infection to ensure adequate ventilation. Woollen socks should be prohibited (Berberian, 1938), and cotton or "cellular" socks worn instead. Rubber shoes are bad as they increase local temperature and humidity, and sandals or shoes with open uppers should be used.

In the presence of a superadded pustular infection, 1 : 4,000 potassium permanganate solution, or 1 : 5,000 perchloride of mercury solution, should be used as a bath twice daily, and the feet should be powdered between treatments. When the eczematoid element has been cured, an ointment should be rubbed in. The number of inunctions per day will again depend on the individual reaction. Castellani's paint has a justly deserved reputation in eczematoid ringworms, but it usually requires to be supplemented by an ointment when the case has reached the dry stage.

With salicylic ointments interdigital curettage should be done once weekly and the socks should be boiled frequently. Pedal hyperidrosis, if present, must be treated, and the following will be found effective : Equal parts spirit vini meth. and water morning and night, or a foot bath of 5 per cent formalin once daily for ten minutes.

Subsequent to cure, regular prophylactic measures, as detailed later, should be carried out.

#### TREATMENT OF *TINEA UNGUIUM*.

As the primary focus is in the nail bed, the difficulties in the treatment of nail infections can be appreciated. Undoubtedly the best method is to

avulse the nail under local or general anæsthesia and apply antimycotic agents to the bed. In most cases this will suffice, but occasionally it will be necessary to destroy the nail permanently. A more tedious method is to apply liquor potassæ and scrape away the softened layer. Whitfield (1934) advises an ointment of 12 per cent benzoic acid and 6 per cent salicylic acid. This should be strapped over the infected parts daily. The nails will come off in about three weeks and as a rule no further treatment is required. Fehling's solution as a daily dressing on lint is useful, and evaporation can be prevented by the use of rubber finger-stalls.

Local applications are extremely painful and it may be necessary to use sedative drugs during their use.

#### PROPHYLAXIS.

Prophylactic measures are of two kinds: those directed towards the individual, and those directed towards his surroundings. Of these the former is to be preferred, as the responsibility is thus placed on the individual. General measures such as interceptor baths, etc., are unsatisfactory by themselves.

*Personal.*—Firstly, education on foot hygiene is essential. It is astonishing the number of otherwise cleanly people who do not wash the interdigital spaces when bathing, and an equally large number do not bother to dry them properly. This, I consider, is the basis of most pedal mycoses. The natural warmth of the foot and retained moisture predispose to maceration and the soil is thus prepared for infection. In his investigation on U.S. soldiers, Wilson (1934) found that the largest company had the lowest incidence of foot complaints, due to the fact that the company commander took a keen interest in the welfare of his men. By frequent personal examinations of their feet he produced a most salutary "foot fixation" complex in his command.

The feet should be kept from contact with the bathroom floor as much as possible and paper slippers, such as are used in America, are useful.

I am convinced that the danger period occurs between washing the feet and drying them. An analogy with usual practice would be to wash the hands and rub them on the floor before drying. It is no exaggeration to say that in the height of the summer most common bathroom and bathing establishment floors will grow orchids, to say nothing of a simple organisation like a pathogenic fungus.

Notices should be placed in all washing places and showers. To be effective, such notices should be concise, and the following is suggested as satisfactory :—

#### YOUR FEET.

"Carelessness in washing and drying the feet will lead to eczema and ringworm.

Wash carefully between your toes and powder them after drying.  
Report to the doctor at the first sign of trouble."

The feet and interdigital spaces should be washed with soap and water at least once a day, and finally rinsed with cold water to inhibit sweating. They should then be thoroughly dried and powdered with salicylic acid talc, or rubbed with lemon juice as advised by Belisario (1936). Osborne (Goldsmith, 1936) favours swabbing the toes with 1 per cent sodium hypochlorite solution, but this seems unnecessary in the face of more simple measures. In hot countries "cellular" socks and "ventilated" shoes should be worn at all times. Frequently cramping of the feet is due to shrunken socks and not, as is usually supposed, to ill-fitting shoes.

Cross-infection by towels can be prevented by impressing on the individual the necessity for using only his own towel. In humid countries, facilities for drying towels after bathing should be provided.

*General.*—As bathroom floors are generally suspect, they should be washed frequently with soap and water. Forced ventilation may be necessary to ensure thorough drying. Wooden floors and mats which cannot be properly cleaned should be dispensed with, and tiles or polished concrete substituted. Rubber mats are excellent as they are easily cleaned. Bath stools and benches should be abolished and drying should be done while standing in the bath or shower cubicle. Traffic in the bathroom should be reduced to a minimum.

In the presence of overt infection walls and floors should be swabbed after washing with 2 per cent sodium hypochlorite solution. Formalin is useful, but the room cannot be used for some time afterwards. A shallow rubber bath containing a solution of 1 per cent sodium hypochlorite may be placed at the entrance to the wash place and bathers made to pass through it. The solution should be changed daily. Acidulated 0.5 per cent paranitrophenol solution is efficacious, but unless the feet are rinsed before drying the yellow colour reappears on towels. Sodium thiosulphate does not appear to be satisfactory. Copper salts have not been used in prophylaxis and investigations as to their efficacy would be extremely interesting.

Perhaps the best and simplest method is to sprinkle chloride of lime powder, such as is used for water purification, on the bathroom floor. This soon becomes converted into an adhesive, strongly antiseptic, and altogether objectionable mush, and forces the individual to wash and dry his feet carefully. The subsequent washing greatly lessens the risk of chemical dermatitis. It is also advisable to provide large dredgers of salicylic acid talc or other foot powder.

#### COMMENTARY.

In this article no hard and fast routine for treatment has been laid down as I consider that any logical method in careful hands and under personal supervision will be successful. It must be remembered, however, that ringworm infections are caused by a vegetable parasite which can remain viable for considerable periods, and it will be necessary to eradicate

possible sources of reinfection in the patient's clothes, shoes, etc., before a case can be pronounced "fungus-free."

No mention has been made of X-rays in treatment. Undoubtedly excellent results have been obtained, especially in chronic pedal cases, but the method is too dangerous to be generally adopted.

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## Editorial.

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### TRENCH FOOT.

THE effects of cold in the form of frost-bite or gangrene of the feet have been recorded from ancient times. In 1812 Larrey described the effects of cold in Napoleon's Russian campaign. He seemed to be familiar with conditions experienced in the Great War. He pointed out that frost-bite did not occur when the temperature was steadily below zero, but was apt to appear when the temperature was variable, sometimes above, sometimes below, the freezing point. He said that heat suddenly applied might be the determining course of gangrene. In the medical history of the Crimean War it is stated that cases of frost-bite and gangrene occurred when the temperature was above the freezing point, and especially when there was rain, a cold north-east wind, and frost at night. Factors which helped to bring about the condition were lack of opportunity for changing the clothes, tight boots, fatigue, and defective nutrition. Diseases such as scurvy and "fever" were also factors in its causation. Owing to the conditions in trench warfare men could not move about to assist the circulation, and frequently had to remain at the bottom of a trench knee-deep in mud and water or half filled with snow. Similar cases of frost-bite were described by Davys and Powell Connor among the members of the British Mission to Thibet in 1903; in the Russo-Japanese War in 1904-5 by Macpherson; and again in the Balkans in 1912 by Max Page.

Severe cold, especially when combined with a high wind or a great altitude, produces frost-bite, a more sudden and ultimately more crippling disorder than trench foot. This true frost-bite is the dread of men attached to arctic and Himalayan expeditions and occurs in this country among airmen. Typically, days or even weeks of immersion in mud are needed to produce trench foot.

Colonel Gratton, who was D.D.M.S. of the IXth Corps in the War 1914-18, writes that on the Western Front troops, when carrying out reliefs, had to march several miles from their billets along wet and muddy roads, and as they approached the battle line the going became heavier and very trying to soldiers equipped in battle order. The troops arrived at the entrance to the communication trench more or less fatigued, bespattered with mud and wet; in the days before trench boards were in general use the effort of marching through a long communication trench, sometimes half a mile or more in length, was a feat of endurance which was attended with an immense expenditure of energy. When the men eventually arrived at their stations they had to remain there with little power of movement owing to the depth of liquid mud often at the freezing point.

During the winter of 1914-15 troops might have to remain in their trenches for weeks at a time. When reinforcements arrived in increasing numbers it was possible to arrange for a bout of duty of forty-eight to seventy-two hours in the front line, followed by a similar period in support, before returning to billets for five or six days in reserve. The men were given a

liberal supply of good food and were warmly clad. Also in 1914 it was found possible to supply charcoal braziers in some parts of the line. In some sectors, owing to the waterlogged state of the soil the trenches were merely crumbling earthworks. It was not until sufficient material was available for revetments that it became possible to move in the trenches in comparative safety. In the waterlogged country east of Ypres it became necessary to lay down miles of trench-board tracks before the troops could reach the trenches reasonably dry shod.

As the British front gradually extended in a southerly direction the nature of the subsoil changed from clay to chalk, with the results that the hardships from waterlogged trenches were greatly diminished, and a much greater degree of protection was attained by the provision of dugouts which could be constructed without great difficulty in the solid chalk.

True frost-bite is usually, though not always, of quicker onset. The usual burning sensation of great cold dies away and all sensation in the affected part is lost. At this stage the skin is white; either waxy or sometimes, when the surface is completely exposed, like skin sprayed with ethyl chloride. When fingers and toes are involved the joints become stiff. Thereafter, complete recovery may take place; or after a variable time neuralgic pains may begin. The skin is usually hypo-aesthetic. The nails may fall off and the new nail is malformed for a time. Gangrene of the skin or deeper structures may develop.

Trench foot is generally supposed to be caused by cold, wet, and the effects of pressure. Bacterial infection noted by French, Italian, and British observers has been regarded as a secondary infection resulting from the lowered resistance of the tissues.

In 1900 Rischpler published an account of a research he had carried out. He considered the whole of the phenomena observed were due to inflammation caused by cold. There was early oedema; the cells in the walls of the vessels were swollen and degenerated; the bundles of connective tissue were swollen; the muscle fibres in the media of the arteries showed vacuolation; there was little sign of thrombosis in the vessels, and in general the effects could not be ascribed to thrombosis.

As a result of their experimental work on animals and clinical observation, Lorrain Smith, Ritchie and Dawson concluded that the essential change consists in damage to the blood-vessels; this is manifested by swelling of the endothelial cells of the vessels of all kinds and by the vacuolation of the muscle fibres in the arterial walls. An excessive amount of fluid is consequently poured out into the tissues and in some cases the vessels rupture and hæmorrhage occurs. Along with the injury to vessels there is also an interference with the vitality of the cells of the surrounding connective tissue. Evidence of this is found in the readiness with which fibrin formation occurs in the exuded fluid as contrasted with its absence in the form of thrombi in the blood-vessels. As regards the condition in man these observers drew special attention to the effects of pressure and constriction. They noted that in all the cases seen the lesions were confined

to the feet and were specially likely to occur in the part where corns and callosities were common, that is to say on the inner and outer aspects of the toes, over the joints on the anterior part of the foot, and on the heel.

The D.M.S. of the First Army stated in his diary on January 7, 1915 : "Noted during visits to the C.C.S. grave condition of men coming in with sore feet and found in most cases boots had never been off or even unlaced for days, sometimes weeks, at a time, and that no dry socks were carried."

A lowering of hæmoglobin as estimated by Gower's hæmoglobinometer, in patients suffering from "chilled" feet, was noted by Major Gray when in charge of No. 2 Mobile Laboratory. In an average of 25 controls he found the percentage of hæmoglobin to be 85·5, whereas in the patients with chilled feet the percentage worked out at 77·82.

The general opinion that trench foot is due to cold and impeded circulation was disputed by Médecin-Major V. Raymond and Médecin-Major I. Parisot of the French Army. They claimed to have isolated from the lesions a fungus which was identified by Vuillemin as *Scopulariopsis noninjii*, and found in litter, straw, and manure. They stated that cultures of this fungus, when inoculated into animals, produced all the symptoms of trench foot. They considered the condition was due to infection from the mud in the trenches. At a meeting of the International Congress of Hygiene held in Paris in November, 1919, Dr. Roux, Director of the Pasteur Institute, stated that the conclusions of Raymond and Parisot were not generally accepted, and that their observations had not been confirmed. The consensus of opinion was that trench foot was caused by wet, cold, and conditions which interfere with the circulation in the feet.

The workers in the Clinical Research Department at University College have added to our knowledge of the reaction of the skin to cold. Their work has given a possible explanation of the action of mud in producing at comparatively high temperatures damage nearly akin to frost-bite. Lewis and Love have shown that the skin begins to freeze when its surface temperature is reduced to a point between  $-2\cdot2^{\circ}$  C. and  $-25^{\circ}$  C., the wide variation being due to the factor of super-cooling—the capacity, that is, to go below freezing point without solidifying—a factor which varies with different people. Super-cooling does not harm the skin, prolonged freezing does. The capacity to super-cool may be abolished by soaking the skin in water; the skin which does not super-cool may be induced to do so by leaving it unwashed for a week, or by rubbing in olive oil, an observation that gives authority to the use of whale oil.

At altitudes above sea-level the effects of a low pressure of oxygen are important. The increased pulse-rate has been shown by Doi, Schneider, and Barcroft, to be a sign of distress and is accompanied by a reduction of the minute volume of the heart. When the supply of oxygen is deficient the skin bears the brunt and may be predisposed to frost-bite; there is no doubt that oxygen should be administered at the earliest possible moment in any case of frost-bite above sea-level on a mountain or in an aeroplane.

The greatest wastage from trench foot occurred on the Western Front

in France and Flanders ; there was also serious wastage in Gallipoli and Macedonia. According to the statistical branch of the Medical Research Council frost-bite among the British in France and Flanders was as follows : August, 1 ; September, 1 ; October, 41 ; November, 1,555 ; December, 4,823. The term "trench foot" does not appear to have been generally adopted until the end of the winter 1914-15. In December, 1914, eight cases diagnosed trench foot were admitted to hospital.

In the First Army there were more than 3,000 cases of trench foot between December, 1914, and February, 1915, but after strong disciplinary measures had been taken in the First Army to prevent the occurrence of trench foot, from the middle of January onwards the disease became more or less negligible at a time when it continued to have a very high incidence in the Second Army in the sectors of the Ypres salient. The war diaries give some indication of the incidence of foot troubles in Gallipoli during the period November 25 to December 20, 1915, but the number of admissions was much greater than shown, as many diaries simply stated that "many" or several admissions occurred without giving any numbers. The figures given were : Frost-bite 3,607, trench foot 1,322.

In Macedonia from November 29, 1915, to April 4, 1916, 962 cases of frost-bite and 336 cases of trench foot were admitted to hospital. Of the former 767 occurred during the week ending December 4, 1915.

In slight cases of trench foot there may be no abnormal appearance, but there is severe pain and acute cutaneous hyperæsthesia, which may persist for several weeks. The skin is first white then mottled and bluish red, or the whole foot may be red and swollen resembling a large chilblain, to which affection trench foot of this degree is very closely allied. In severe cases the foot is always swollen and the swelling may extend to the knee. In these cases the whole foot is absolutely numb at first, but becomes very painful after a few days' rest in a billet or field ambulance. It was quite common for men to have no feeling that there was anything wrong with their feet while in the trenches, even though the toes were already dead. In some cases blisters occur and they may be large and numerous. In still worse cases the toes may be purple or black. In many cases the blackness did not mean deep gangrene and most of the toes recovered. In a few cases the toes died, and in a very few cases the whole foot became completely gangrenous. Subjects from trench foot often developed tetanus. Bruce drew attention to the importance of prophylactic injection of anti-tetanus serum. He wrote "the disease wastes no time in local manifestations but bursts out as generalized tetanus and runs an acute and fatal course in twenty-four to forty-eight hours."

The treatment of the acute stage when the affected part is regaining its warmth is important as it is recognized that heat greater than that of the human body is harmful. The danger of fires, hot-water bottles, and hot-water baths is obvious, for the stagnant circulation is incapable of carrying away this heat. Smith, Ritchie and Dawson showed that water at 37° C. will cause rapid œdema. Lewis and Love have shown that transudation



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may be excessive and have even suggested obstructing the circulation in the frost-bitten parts during the stage of thawing. Raymond Greene considers that rubbing the affected parts even with snow is dangerous. Apart from the danger of increasing the congestion there is the possibility of further harm to the damaged tissues.

In the treatment of slight cases of trench foot it is only necessary to allow the patient to lie down so as to keep the feet elevated. In all cases the affected part must be carefully and gently cleansed and wrapped in dry sterile dressings and many layers of wool.

An injection of antitetanus serum should always be given. Alcohol should not be given owing to the peripheral dilatation it produces. The patient should be given hot drinks and removed to a place of comfort. Bullæ should be punctured and dressed with some antiseptic. In later stages slight cases are stated to be benefited by short-wave treatment.

Gangrene of the toes is best treated by amputation of the toe or toes after a week or more has been allowed for the circulation of the foot to improve.

In the case of apparent gangrene of the foot it is never right to amputate at once, for in the majority of such cases most of the foot recovers. If the gangrene is dry it is well to wait for "a line of demarcation," but if moist it is often necessary to amputate earlier. It must be remembered that the line of demarcation is often late in forming, and the skin may be destroyed over a wider area than the deeper tissues.

In 1914-18 the prevention of trench foot consisted in maintaining the men in as fit a condition as possible. The particular measures were the protection of feet and legs from mud and wet and keeping them dry, warm, and clean, in fact making a fine art of the toilet of the feet; improving the condition of the trenches; and providing the men with hot food. Special clothing and special boots were issued; large sizes of Service boots were necessary to counteract the shrinkage caused by wet and also to allow the men to wear two pairs of socks. Gum-boots with thigh extensions were issued, and in order to avoid the necessity of walking a greater distance than necessary gum-boot stores, where the articles were issued to the men and where they left their boots, were selected as close to the firing line as possible. In exceptional cases these stores were located as near as 1,000 yards to the front line in a dug-out excavated from solid chalk, but usually they were at a greater distance, about 5,000 yards or more. When gum-boots were used for marching the inside of the boots became wet from condensed perspiration and the breeches or trousers protected by the indiarubber extension became soaked from the same cause. Gum-boots had to be dry inside when issued from the stores. This was effected by driving hot air into them through a pipe fitted with rubber tubing through which the hot air was blown right to the end of the boot. Two pairs of woollen socks were recommended to be worn and the gum-boots had to be large enough to allow the socks to be worn with comfort. If the straps at the ankle were carefully adjusted the wearer could walk without the heel slipping

up and down inside the boot. It was advised that the boots should not be worn for more than thirty-six hours. Many officers stated that they obtained the greatest benefit from gum-boots when they put them on in the trenches. They preferred to walk up in their ordinary boots and change on arriving at their destination. For the supply of dry socks to men in the trenches "divisional sock stores" were formed under the charge of the "baths officer." Waterproof bags full of clean dry socks were sent up to the trenches every night with the rations in sufficient numbers to allow every man to have a fresh pair of socks every twenty-four hours. The dirty socks were sent down by the same route, and were collected and sent to the laundries daily. In order to maintain the circulation in the feet and legs men were encouraged to move about in the trenches. Other measures were the removal of boots and foot-rubbing drills with massage.

Rest and recuperation in a correct posture when off duty were important factors in preventing trench foot. If the men were then left to themselves and allowed to spend their time in a crouching position on the side of the wet trench or sitting on the fire step, then the time off duty increased the liability to trench foot. Captain Hughes, writing of his experiences as a regimental officer, attributed cases to the habit men had of sleeping in a sitting posture on the fire-step of the trenches. The sharp edge of the trench pressed on the popliteal space and induced coldness of the feet. He arranged that when men were on duty in pairs the man whose turn it was to rest should lie with his feet up on the fire-step and sleep in his greatcoat and two blankets, his own and that of his comrade. The result of these measures was that no cases occurred in twelve days of inclement weather in the battalion under Captain Hughes' charge.

The supply of a liberal ration of hot food in the trenches did much to counteract the harmful effects of exposure. The ordinary camp kettle full of hot stew was placed in a hay-box which was slung on a pole and carried by two men up to the trenches. After the soldier had filled his mess-tin with stew this was heated up by means of a "Tommy's cooker," a small stove in which solidified alcohol was burned. Brigade soup kitchens were also organized, and were located close to the gum-boot stores, where men were given a cup of hot soup when changing their boots. Troops coming out of the trenches were served with hot soup in the same places.

Experiments were made with foot-grease and powders, but whale oil was preferred and was rubbed well into the feet until the skin was practically dry. The objections were its offensive smell and uncleanness. Later on the method advocated by Médecins-Major Raymond and Parisot of the French Army was adopted in place of the oil. Before going into the trenches the men washed and dried the feet thoroughly and then applied a powder of borated chalk and camphor which was also dusted inside the socks. When in the trenches the men wore gum-boots and were provided with a daily change of clean socks.

"Foot-washing centres" were an unqualified success and constituted an important link in the chain of preventive measures; they were much

appreciated by all ranks. After leaving the trenches no time must be lost in making the men as comfortable as possible ; their clothes should be dried and arrangements made for baths and a change of clean clothing. It should be remembered that as much harm may result from men waiting about in billets with sodden boots and socks as if they were actually in the trenches.

By the adoption of these preventive measures immediate results were obtained, and trench foot practically disappeared from all the divisions of the First Army except one. When inquiry was made, it was found that the battalion medical officer and not the company officer had been made responsible in divisional orders for the preventive measures. When this was rectified, good results were at once obtained. This incident emphasizes the importance of placing the responsibility for the proper care of the men's feet on the company and platoon officers.

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#### REFERENCE LIBRARY FOR THE MEDICAL BASE IN FRANCE.

THE Royal College of Surgeons are providing a Reference Library for the Medical Base in France.

We are informed that the library will include provision of the current issues of over forty scientific journals, as well as a large collection of volumes, to be kept up to date, covering the fields of surgery, medicine, pathology, and the allied sciences. It will give those who are working to improve the known methods of medical treatment ready access to the literature of their subject, and will enable medical officers in general to keep abreast of advances in professional knowledge.

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#### THE ROYAL INSTITUTE OF PUBLIC HEALTH AND HYGIENE.

THE Executive Council of the Royal Institute of Public Health and Hygiene has appointed Lieutenant-Colonel J. S. K. Boyd, M.B., B.Ch., D.P.H., R.A.M.C., to deliver the Harben Lectures for 1940.

His subject will be "Modern Practice in War-time Immunization of Soldiers and Civilians."

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#### THE HARBEN GOLD MEDAL AND SMITH AWARD.

THE Executive Council has decided to award the Harben Gold Medal for 1940 to Sir Leonard Hill, F.R.S., LL.D., M.B., and to confer the "Smith Award" for 1940 upon Sir William Savage, M.D., M.R.C.S., D.P.H., late Medical Officer of Health, County of Somerset.

The Harben Gold Medal is, in accordance with the terms of a Trust created by the late Sir Henry Harben in 1894, awarded triennially to one, irrespective of nationality, who has, in the opinion of the Council, "rendered eminent services to public health."

The "Smith Award" consists of a bronze figure of Hygeia, and is awarded triennially to a medical officer of health who has, in the opinion of the Council, "achieved most noteworthy work in the discharge of his duties."

## Clinical and other Notes.

### TWO RARE TOXIC MANIFESTATIONS DUE TO TREATMENT OF SYPHILIS WITH ORGANIC ARSENIC PREPARATIONS.

BY LIEUTENANT-COLONEL H. G. WINTER, M.C.

*Royal Army Medical Corps.*

THE following cases are considered to be of sufficient interest to warrant publication.

*Case 1.*—R/m ———, 1/R.U.R., aged 22.

Diagnosis : Symptomatic toxic purpura.

Exposed to venereal infection at the beginning of December, 1936, and developed phimosi with a subpreputial discharge on December 22, 1936. A month later, on January 22, 1937, a slight rash was discovered on his body which, the next day, is described as "Rash more definite, resembles papulo-roseolar syphilide." On January 23, *T. pallida* were detected by dark-ground examination of exudate from sores on the penis. It is of interest that Wassermann and Kahn tests carried out at intervals from January 1, 1937, throughout treatment and during the surveillance period to date, have always been negative.

Antisyphilitic treatment was commenced on January 24, and subsequent treatment was very irregular ; there were several breaks of varying duration, one being as long as four months.

For the first twenty-one injections sulphostab (Boots) and bismostab (Boots) were given. No toxic symptoms are recorded, his urine was normal, and his weight remained steady between 142 and 145 pounds.

He received his twenty-first injection on the H.T. "Nevasa" on December 1, and arrived in India during the Trooping Season, 1937-38. Treatment given at Rawalpindi was as under :—

Date	No. of injections	Arsenical dose	Bismuth dose	Urine	Weight
January 12, 1938 ..	22	0.45 gm.	0.2 gm.	N.	139
January 19, 1938 ..	23	0.45 "	0.2 "	N.	145
January 26, 1938 ..	24	0.45 "	0.2 "	N.	145
Rest.					
February 9, 1938 ..	25	0.6 "	0.2 "	N.	144
February 16, 1938 ..	26	0.6 "	0.2 "	N.	144

Both arsenic and bismuth were given by the intramuscular route and the patient was interrogated, clinically examined, and given sugar before each injection.

The arsenic preparation administered was sulpharsphenamine (May

and Baker), batch No. 0098, date of manufacture July, 1936, and the bismuth bismostab (Boots).

On February 17, 1938, he was admitted to hospital with a purpuric rash and, on being closely questioned, stated that he had had a faint rash after the injections on February 9, but had not mentioned it when he came for injection on February 16 because he thought it was nothing and possibly due to new khaki clothing. He further asserted that throughout his previous antisyphilitic treatment he had had no unusual symptoms or signs at any time.

On admission to hospital he was found to have a diffuse purpuric rash over the lower part of his body, legs, and feet. There was an extravasation of blood under the skin of the buttock round the site of injection of the arsenic but not on the other buttock, the site of injection of the bismuth. There were, also, submucous hæmorrhages on the palate, fauces, and the inner sides of the cheeks. The patient's general condition was excellent and he complained of no pain or other symptoms and stated that he felt quite well. Temperature 97° F.

Total white blood-cell count : 9,000 per c.mm. Differential count : Polymorphonuclears 67 per cent ; lymphocytes 23 per cent ; large mononuclears 7 per cent ; basóphils 3 per cent.

Abnormal red or white cells not seen.

Coagulation time : More than five minutes ; end-point not reached.

The general appearance of the stained film suggested a very marked decrease in blood platelets.

The patient was put to bed on a milk diet and given 15 grains of sodium thiosulphate three times a day orally and 0.3 gramme in 12½ per cent sterile distilled water intravenously ; campolon, 1 c.c. intramuscularly.

On February 18 the patient's temperature remained at 97° F. and he complained of cold, otherwise his general condition was excellent. At the sites of injection of the sodium thiosulphate and campolon, given on February 17, and of the bismostab, given on February 16, large extravasations of blood under the skin were now apparent ; apart from this there was no extension of the rash and previous lesions were fading. Sodium thiosulphate and campolon were discontinued ; collosol calcium, intramuscularly twice daily, and calcium lactate, by the mouth, were now commenced.

The patient continued to improve rapidly and, on February 24, the total white blood-cell count was 6,800 per c.mm. Differential count : Polymorphonuclears 63 per cent ; lymphocytes 29 per cent ; large mononuclears 5 per cent ; eosinophils 1 per cent ; basophils 2 per cent. No abnormal cells seen. More blood platelets than in previous film. Coagulation time (at room temperature), eleven minutes.

He was discharged from hospital to duty on February 28.

On August 4 his total white blood-cell count was 5,800. Differential count : Polymorphonuclears 58 per cent ; lymphocytes 30 per cent ; large mononuclears 11 per cent ; basophils 1 per cent. Coagulation time : Five and three-quarter minutes. No abnormal cells seen.

Up to the time of writing, May, 1939, he has remained in good health and is, in fact, now serving on active operations in Waziristan.

Case 2.—Pte. ———, 1/Devons, aged 24.

Diagnosis : Hæmorrhagic encephalitis.

Exposed to venereal infection at Rawalpindi about Christmas, 1938. Admitted to hospital on March 29, 1939, with a granulating, indurated sore, about  $\frac{1}{4}$  in. in diameter on the left side of the inner surface of the prepuce. Dark-ground examinations of the exudate from the sore were negative on the day of admission and again on March 30, but on March 31 *T. pallida* was detected. The Wassermann reaction and Kahn test were negative on March 29 and on March 31.

The patient denied having any previous illnesses and there were no entries in his medical history sheet. He was a well-built, muscular, and healthy young man ; urine normal ; weight 132 pounds.

On March 31, after physical examination and administration of sugar, he was given 0.45 gramme of sulphostab (Boots) batch No. S87, date of manufacture August 17, 1937, and 0.2 gramme of bismostab (Boots), both intramuscularly.

On April 5, 1939, the sore was clean and healthy and his general condition was good ; he complained of no untoward effects from the first injections and exhibited no signs of intolerance ; his urine was normal and his weight 130 pounds.

After administration of sugar he was given a second dose of 0.45 gramme of arsenic and 0.2 gramme of bismuth, intramuscularly, the same drugs being given as before. Blood taken before his injection on April 5 was strong positive, 0/0 to the Wassermann test ; he was, therefore, diagnosed " Syphilis, fresh, medium primary."

On the morning of April 7 he complained of slight nausea and headache and stated that he had felt " feverish " the evening before but did not report it. On examination he was found to have a definite rash on the trunk, limbs, palms of the hands and soles of the feet ; there was no irritation. Temperature 102° F., pulse 100.

He was placed on a milk diet and kept in bed ; sodium thiosulphate, 15 grains, four-hourly, orally, and calciostab (Boots), 0.6 gramme, intravenously, were given. In the evening of the same day his temperature went up to 104° F., pulse 100. He complained of nothing and stated that he did not feel uncomfortable. The rash was now more marked and was, definitely, of the scarlatiniform type. He was tepid sponged and given aspirin, 10 grains.

On the morning of April 8 the scarlatiniform rash was even more marked, especially on the chest and abdomen, and on the dependent parts of the back was petechial. There was also well-marked œdema of the hands and arms but none in the feet or ankles. Apart from nausea and vomiting of clear fluid, the patient complained of no discomfort and stated that he felt quite well ; there were no mental or nervous symptoms. The temperature



had dropped to 100·4° F., pulse 92 ; he was constipated. Given 0·6 gramme of calsiostab intravenously, and magnesium sulphate 2 ounces orally ; sodium thiosulphate continued by mouth.

During the day his condition gradually worsened and vomiting became a marked feature.

The temperature dropped to 95° F. and remained there to the end. He was given 0·5 c.c. of 1 : 1,000 adrenaline hydrochloride intramuscularly, and 1 : 1,000 adrenaline hydrochloride, 10 per cent in glucose D solution, one drachm four-hourly, by the mouth (Kromberger's adrenaline syrup). Sodium thiosulphate by the mouth was discontinued and sodium bicarbonate and sodium citrate substituted.

During the afternoon and evening he complained of feeling cold ; extra blankets and hot-water bottles were applied. Later in the evening he broke into a cold, clammy sweat, and complained of numbness of the feet. At this time the rash was frankly purpuric and had extended, including the mucous membranes. There was no loss of sensation and reflexes were present ; no mental symptoms.

At 8.30 p.m. he became restless but soon settled down again. At 12 midnight mental symptoms developed for the first time ; even then they were only mild—he tried to get out of bed and refused to take his medicine ; otherwise his mental outlook was clear and he was quite rational up to about five minutes past twelve, when he suddenly dropped back on his pillows, his breathing became loud and stertorous, and he became unconscious ; conjunctival reflexes were now absent.

He never recovered consciousness and died at 12.20 a.m. on April 9. He had no fits, twitchings, or convulsions of any kind at any time ; just before death supervened his breathing became shallow and irregular.

Post-mortem examination, carried out by the D.A.D.P., Rawalpindi District, on the morning of April 9, revealed very marked congestion of the pia arachnoid membrane, marked œdema of the brain, and multiple hæmorrhages throughout the brain substance.

#### COMMENTARY.

Both purpura and hæmorrhagic encephalitis are, fortunately, rare toxic manifestations. One case of fatal purpura has been recorded in this Journal (Buist, 1925). David Lees stated that nine cases of hæmorrhagic encephalitis, five of which recovered, came under his notice (Lees, 1931). These conditions, however, appear to be more common in America than in this country ; Padget and Moore (Johns Hopkins University) reviewed 264 articles on syphilis which appeared between July, 1936, and July, 1937, and found that dermatitis, amblyopia, jaundice, encephalitis, and purpura, were the most frequently reported complications. Hæmorrhagic encephalitis appeared to be due to arsenical overdosage in the 135 cases collected by Cormia (Wise and Sulzberger, 1938). It cannot, however, be charged that there was any overdosage in the cases under review.

The conditions were undoubtedly due to toxic action of the organic arsenic preparations given, but it is not considered that they were in any way the result of extra toxicity of the drugs used. The particular batch of sulpharsphenamine had been used in hundreds of cases without producing toxic symptoms and the batch of sulphostab had, similarly, caused no symptoms in other cases; moreover, a case of medium primary syphilis, admitted the same day as Case 2, was treated at the same times with the same batch and is quite well. Both batches were reported to the Medical Directorate, Simla, and it has been ascertained that no further report as to the toxicity of these batches has been received from other stations in India.

In a number of reported cases general debility, alcoholism, intercurrent influenza (especially the latter), etc., are undoubtedly contributory causes, but in a large number (as in the cases under review) the victims are, apparently, physically fit and healthy individuals. It would seem that there must be in each case some other factor present, such as insufficient adrenaline in the blood (Milian and Erlich) or other endocrine disturbance (Lees, 1931). In the case of hæmorrhagic encephalitis a reaction in the nature of a Jarisch-Herxheimer has been suggested (Memoranda on Venereal Diseases, 1936). It has been pointed out by Harrison and by Anwyl Davis and Mellanby that arsenobenzol reacts with fibrinogen and delays blood coagulation. Rabut and Oury suggest that it is the benzol radicle which causes toxic symptoms (Buist, 1925).

The two conditions are closely allied. As a general rule they occur twenty-four to forty-eight hours after the second or third injection of the resumed course in old-standing cases in which treatment has been intermittent.

Case 1 illustrates the danger of intermittent and irregular treatment. Fortunately this case was mild and reacted well to appropriate treatment.

Case 2 was in many ways unusual. The patient was an early case of syphilis in which the disease had only just become generalized; he had had no previous antisyphilitic treatment and was physically fit. There was, therefore, no reason to anticipate any serious toxic disturbance, especially as all precautions were taken against any such event.

Almost up to the time of his death his general condition was excellent and he presented no symptoms which pointed to involvement of the brain or meninges.

Lumbar puncture and/or venesection were considered, but at first his general symptoms and signs were not sufficiently grave to warrant this procedure; later the progress of the disease was so rapid—twenty minutes only—that there was no time. Post-mortem findings, moreover, make it doubtful whether such treatment would have been of any avail.

It is for consideration whether, in the light of these two cases, it would not be advisable to perform lumbar puncture and drainage and/or venesection in every case of toxic purpura due to organic arsenic compounds whether they have mental or nervous symptoms or not. By such prophylactic treatment, severe "serous apoplexy" might be avoided.

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I am indebted to Major F. J. Hallinan, R.A.M.C., and Major R. N. Phease, R.A.M.C., for assistance in laboratory and post-mortem findings, and to Colonel E. G. S. Cane, D.S.O., for permission to report these cases.

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## NEW APPLIANCES FOR THE RECOVERY AND TRANSPORT OF CASUALTIES IN FORWARD AREAS UNDER FIRE.

BY MAJOR ST. CLAIR BARRETT,  
*Royal Army Medical Corps, T.A.,*

AND

COLONEL E. M. COWELL, *C.B.E., D.S.O.*

THE stretcher bearers, whether regimental or R.A.M.C., have a difficult, laborious, and dangerous task. They deserve any assistance that may be given by the provision of new and improved appliances.

The special problems which confront the regimental stretcher bearers are: (1) How to bring in a man from no-man's-land in the dark and under fire. (2) How to carry a loaded stretcher down a narrow trench with frequent traverses.

The R.A.M.C. bearers have a longer carry, they may have to take cover on the journey, conservation of man-power is important, and the time factor comes into play.

### THE GROUND-DRAG (figs. 1 and 2).

A special grip (claw) has been devised which can be rapidly attached to the collar of the man's tunic or battle-dress (fig. 1). The stretcher bearer

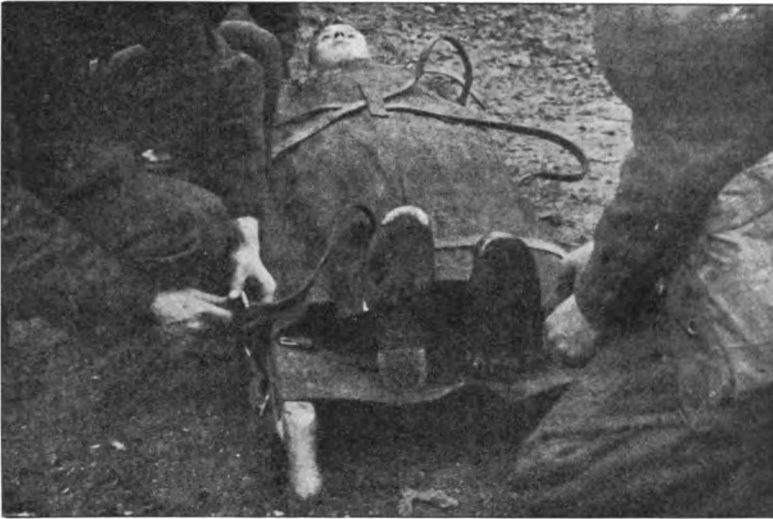


FIG. 1.



FIG. 2.

FIG. 1.—The "claw" grip. The man's blouse or tunic is loosened and the claw applied. The spare cloth is pulled up allowing protection for the patient's head as he is dragged along.  
 FIG. 2.—The ground-drag in action, showing concealment.



**FIG. 3.**—Universal stretcher sheet, showing method of application. Three body straps attached to clips secure the patient to the stretcher. Two straps are buckled on to the runners. Two loop-straps secure head and feet. The sheet can be detached in a few moments.



**FIG. 4.**—Lateral carry. The stretcher has just been carried through a narrow trench with traverses, and up steep steps.

crawls out and places the grip in position. The loop of the attached webbing is passed over the bearer's shoulder and he proceeds to crawl back, dragging the casualty behind him (fig. 2).

Attempts have been made to drag a loaded stretcher along the ground, but are generally unsuccessful.



FIG. 5.



FIG. 6.



FIG. 7.

FIG. 5.—Hip sling. Vertical carry. Note bearers' hands are free. The V straps coming off the belt allow the weight to be transmitted down the line of the femur, no matter what position the bearers take.

FIG. 6.—Hip sling, at the stoop. Bearers can proceed at a rapid pace in this position, taking advantage of cover.

FIG. 7.—Hip sling, at the crawl. In this position a loaded stretcher can be carried in a tunnel with a 2-foot roof. The poles of the stretcher should be taken out of their special loop and placed at the apex of the V straps.

#### THE UNIVERSAL STRETCHER SHEET (figs. 3 and 4).

This apparatus is described in the R.A.M.C. Training Manual, 1935, but is not illustrated.

The sheet can readily be applied to the loaded stretcher, and then converts the Army stretcher into the Neil-Robertson type. That is, the stretcher can be carried in any position, ensuring safety and comfort to the casualty.

In addition, extra warmth is provided and protection in bad weather. The man cannot fall off if one of the bearers stumbles, and traverses can be negotiated without the provision of a special trench stretcher.

On completion of the carry, the sheet is quickly detached and taken back to the R.A.P. It is not necessary to provide sheets for all stretchers ;

it is suggested an establishment of 10 per cent might be held by field ambulances.

In any combined naval and military operations the sheet is especially useful, and also it is of great value in air medical transport.

#### THE HIP SLING (figs. 5, 6, and 7).

This device enables two bearers, with one relief, to transport their loaded stretcher with ease, speed, and absence of fatigue. The weight of the stretcher is carried from the hips. A broad belt is strapped above the crests of the ilium with a Y-shaped strap attached in such a way that the vertical limb hangs down the line of the femur, no matter what position the bearer adopts.

The bearers' hands are left free for adjusting respirators, steadying themselves, or feeling the way in the dark. Two men can carry a loaded stretcher one mile in forty minutes with rests.

If it is necessary to take cover the bearers can stoop (fig. 6), or even crawl (fig. 7).

#### CONCLUSION.

By the use of these stretcher-bearing devices : (1) It will be possible to bring in men under heavy fire where no other means can be adopted ; (2) traverses can be passed without using special trench stretchers ; (3) the work of the stretcher bearer is lightened and the time performance greatly improved.

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### A CASE OF GONORRHOEAL OPHTHALMIA ABORTED BY EARLY TREATMENT.

BY LIEUTENANT-COLONEL J. BIGGAM, M.C.

*Royal Army Medical Corps.*

*History.*—On March 26, 1938, at 9.30 a.m., Corporal H., R.A.M.C., was, in the course of his routine duties, making smear preparations from cases of gonorrhœa. As his right eye felt slightly irritable, he rubbed the lid with the back of his right hand, thinking that this would be safe.

Half an hour afterwards the right eye began to burn and felt as though it had an eyelash in it. He bathed the eye with boric lotion. As it felt worse ten minutes later, and began to look inflamed in the right corner, he came to the Ophthalmic Department (a hundred yards away) at once. He was examined immediately.

*Condition on Examination.*—The left eye was normal. The right eye showed a slight but definite localized inflammatory redness of the bulbar conjunctiva from the temporal side of the corneoscleral margin to the outer canthus. The eye was said to feel irritable. There was no other abnormality.



*Treatment.*—In view of the history, the upper and lower lids of each eye were everted, and were painted generously for twenty seconds with 2 per cent silver nitrate solution on cotton-wool-armed match-sticks, special attention being paid to the canthi. In addition, after the lids of the right eye had been allowed to resume their normal position, they were retracted by hand pressure on the orbital rim, and several drops of 2 per cent silver nitrate solution were poured into the upper and lower conjunctival fornices and, after a few seconds, washed out with saline. This treatment was given at 10.15 a.m.

At 5 p.m. the same day the right eye was more painful, the conjunctiva was acutely inflamed all over, and there was a slight yellow purulent discharge. The conjunctiva of the left eye was still mildly reddened as a result of the morning's silvering, but otherwise normal.

Methylene blue stained smears from the discharge from the right eye showed pus cells containing considerable numbers of kidney-shaped intracellular diplococci. Slides taken at the same time and stained by Gram's method showed that these organisms were Gram-negative intracellular diplococci morphologically indistinguishable from gonococci.

The patient was immediately taken in hand as an established case of gonorrhoeal ophthalmia.

Next morning, less than twenty-four hours after the first symptoms, the right eye was almost painless, opened easily, was less injected than on the previous evening, and had only a trace of discharge which failed to show any diplococci, and from that time on rapidly whitened and gave rise to no anxiety.

*Comment.*—It would appear that an undoubted case of gonorrhoeal ophthalmia in an adult had been aborted by the early and somewhat severe application of 2 per cent nitrate solution locally, before the diplococci had had time to "dig in."

It is, of course, possible that the patient did not infect himself at 9.30 a.m., while taking smears from gonorrhoeal cases, but that the infection occurred previously, and the slight irritation then felt in the right eye was really the first symptom of the disease.

From other evidence, however, which has not been gone into here, the former would appear more likely.

In a private communication Dr. S. H. Browning, to whom I referred the notes of the case, considered that if the infection occurred at 9.30 a.m. it was quite possible that pus cells containing considerable numbers of intracellular gonococci could be recovered from the conjunctival sac by 5 p.m. the same day.

Consideration of the case described suggests that it might be advisable to :—

(1) Keep a special emergency box in clinics dealing with gonorrhoeal cases, the box to contain a small amber coloured or brown paper-wrapped bottle of 2 per cent silver nitrate (the solution being changed every three

months), and several ready prepared cotton-wool-armed match-sticks for the application of the solution.

The "match-sticks" should be made up in the manner of the throat swabs in ordinary use, plugged into test tubes and sterilized before storage.

(2) Train "Special Treatment Orderlies" and others employed in venereal wards in the exact method of the efficient application of silver nitrate solution to eyes likely to have been infected by discharge containing gonococci.

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## Echoes of the Past.

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### TWENTY YEARS AFTER.

BY H. SKIPTON STACY, M.D., Ch.M.(Syd.), F.R.A.C.S.

*Honorary Consulting Surgeon at Sydney Hospital, Ryde Hospital, and Royal South Sydney Hospital.*

(Continued from p. 112.)

### III.—GUNSHOT WOUNDS OF ABDOMEN (Continued).

#### CASE 48.—Retroperitoneal Hæmatoma with Gas Infection.

*Clinical History.*—Nature of wound: Gunshot wound, right loin. (Shrapnel.)

Signs and symptoms: Wound in the right loin just to one side of the mid-line; wound of exit near the right costal margin in front. Pulse 80, temperature normal. Operated on shortly after admission. Next day condition fairly good, but pale. In the evening, temperature 102° F., pulse 140, respirations rapid. Next day temperature 100° F., pulse 160, respirations very rapid. Is pale; mentally, perfectly clear. Abdomen lax. No distension. Wounds look healthy. Died that afternoon.

Operation: Anterior and posterior wounds excised; track through the right psoas, which was quite healthy, horizontal incision made along the costal margin; large retroperitoneal hæmatoma seen; also a puncture of the hepatic flexure of the colon, and a wound of the edge of the right lobe of the liver. There was a slight escape of bowel contents on manipulation, but this was mopped up carefully. The wounds of the liver and bowel were sutured. There was also a small wound of the diaphragm into the lowest part of the pleural cavity; this was sutured. A small tube was put just into the loin wound.

Survival: About forty-eight hours.

*Post-mortem Result.*—Chest: Except for hypostatic congestion the lungs were normal.

Abdomen: The skin in the loin and down to the groin was bronze; the superficial fascia was darker than normal; the underlying muscles were

normal. The liver and bowel wounds were in good order. The retroperitoneal hæmatoma had undergone liquefaction into a brownish foul fluid, extending medially to mid-line and downwards to the brim of the pelvis. The track of the missile was seen through the right psoas, which was quite healthy except for the small amount of necrosis usual around the track of a missile.

Comments : Death evidently due to gas infection of the retroperitoneal hæmorrhage. (Gas infection may spread in blood-clot as in muscle.) It had spread along the loin wound, and round the abdominal superficial fascia towards the front. Probably the infection in this case came from the bowel contents, rather than introduced from the clothing or skin, as is usual. A free opening of the loin wound and removal of blood-clot, with the insertion of a large drainage tube might have averted death ; the tube used was too small and was not inserted far enough ; also the loin muscle had more or less prevented proper access to the hæmorrhage.

The rapid breathing was due to toxæmia.

CASE 49.—Hæmothorax, Pulmonary Hæmorrhage, and Retroperitoneal Hæmorrhage. Shock.

*Clinical History*.—Nature of wound : Gunshot wound, right flank.

Signs and symptoms : A small wound in the right flank about two inches to the right of the spine. Much abdominal distension but no rigidity. Survival : Twenty-one hours after wounding.

*Post-mortem Result*.—Chest : Heart normal. Left lung normal except for some bronchitis. About seven ounces of dark fluid blood in the right pleural cavity. The lower edge of the lower lobe of the right lung is full of blood ; no wound seen. No wound found in the pleura, either parietal, visceral, or diaphragmatic.

Abdomen : Extensive right perinephritic hæmorrhage with a clean-cut laceration of the upper pole of the right kidney. The wound in the back was small, and could not be definitely traced to the damaged area, but no doubt did so ; the probe so easily gets into the wrong plane. Hæmorrhage extended just beyond the mid-line but the left kidney was normal. No peritonitis. Large intestine very much distended from cæcum to splenic flexure ; there it ended abruptly.

Comments : Presumably died of shock due to extensive retroperitoneal hæmorrhage ; possibly this hæmorrhage through its effect on the sympathetic plexuses was the cause of the distension of the large bowel. The pleural and pulmonary hæmorrhage was evidently due to concussion (both surfaces of the diaphragm were searched and no lesion could be found).

CASE 52.—Wound of Ileum, Colon, and Bladder, with Peritonitis.

*Clinical History*.—Nature of wound : Gunshot wound, abdomen. (Machine-gun bullet.)

Signs and symptoms : Shot in no-man's-land ; walked into the trenches was put on a stretcher, then in ambulance, reaching here six hours after

wounding. Has a wound in the left iliac region. Frequent desire to micturate; the urine he passed did not contain blood; the first ten ounces drawn off was likewise free of blood, but the last few ounces contained some. Was cold and collapsed. Liver dullness absent. Much abdominal rigidity. Later on in the day, after operation, he was still conscious, but face was pinched and pulse very feeble. Died some hours later.

**Operation:** About four hours after admission a median infra-umbilical incision was made; urine, blood, and some faecal material were found in the peritoneal cavity. Iliac colon punctured; it was sutured. Several wounds of the ileum were also sutured transversely. An intraperitoneal wound of the bladder near the fundus was also sutured. Already there was peritonitis. A drainage tube was put in from the left flank down to Douglas' pouch; another one inserted through the perineum up into Douglas' pouch. Catheter tied in the bladder through the urethra.

**Survival:** About twenty-four hours.

**Post-mortem Result.**—Abdomen: Peritoneum much engorged; some pus and lymph present. Wounds were apparently all secure.

**Comments:** He was received too late to save; perhaps if he had not walked in from no-man's-land he might not have extravasated faeces, etc., but the bladder wound, in addition to the bowel injuries, would probably have proved fatal in any case.

CASE 53.—Hæmothorax. Wound of Liver and Perinephric Hæmorrhage.

**Clinical History.**—Nature of wound: Gunshot wound, arm and chest. (Bullet.)

**Signs and symptoms:** Hit through the right arm, then the right side of chest, entering in a downward direction through the 8th rib in the mid-axillary line. He had a hæmothorax, which bacteriological examination showed to be infected. Several days later developed jaundice, and the fluid from the chest was bile stained. Abdomen became distended, but not rigid. Temperature and pulse were considerably raised. Vomiting.

**X-ray report:** Showed shrapnel bullet lying on the 12th dorsal vertebra; a honey-combed appearance throughout the abdomen, and a diffuse dense shadow in the right kidney region. Also a shadow in the right side of the chest (probably hæmothorax).

**Operation:** On the first day of admission a tube was put in, low down in the chest; not much came away. Later on, under gas and oxygen, he was operated on in a ward; portion of the rib just below the scapula was removed; not much fluid came away, although the exploratory needle had shown it to be present. He died about twenty-four hours later.

**Survival:** Several days.

**Post-mortem Result.**—Chest: Both lungs collapsed; some blood-stained fluid in the right pleural cavity; the costo-diaphragmatic sinus was shut off from the rest of the pleura by adhesions, so that the earlier tubes were

not draining the main pleural cavity ; the small cavity they were in was dry ; the tubes had gone through the diaphragm slightly into the liver.

Abdomen : There was a wound of the right dome of the diaphragm, and of the right lobe of the liver, coming out through the inferior surface ; then the bullet had penetrated the posterior parietal peritoneum near the right crest of the diaphragm ; here was a large perinephric hæmorrhage. Much distension of coils of the bowel, which were adherent in many places by flakes of bile-stained lymph ; there was also much bile-stained lymph on the posterior wall of the abdomen ; some free bile in the right kidney pouch just below the inferior surface of the liver—where the wound in the liver was. The bile-stained lymph exudate and the large perinephric hæmorrhage accounted for the appearance in the radiograph. The shadow on the right side of the thorax was partly due to the very high position of the liver (pushed up by distension), and partly to the hæmothorax.

Comments : According to Colonel Rigby, bleeding from a solid viscus generally ceases in about ten hours ; if one were sure that a solid viscus only had been injured, many cases might be left alone, and they would recover, but one is never certain about this.

**CASE 54.—Multiple Wounds of Small Bowel and Stomach with Peritonitis.**

*Clinical History.*—Nature of wound : Gunshot wound, abdomen.

Signs and symptoms : The day after operation seemed fairly well, but the following day he was pulseless and cold. Very little vomiting and no abdominal distension or rigidity. Died that night.

Operation : Small bowel sutured in several places ; there was also a hole in the anterior wall of the stomach, about the size of a crown, and another wound just at the greater curvature.

Survival : About sixty hours.

*Post-mortem Result.*—Abdomen : Peritonitis ; bowels flaked with lymph, and dirty greyish in appearance. Some gas in the peritoneal cavity. The sutured bowel seemed intact ; stomach appeared to be getting gangrenous near the wound. Mesentery torn near the ileum ; lower ileum was collapsed. (? nipped by the torn mesentery.)

Bacteriological examination : Films made from the free blood in the peritoneal cavity showed an organism, probably *Bacillus aerogenes capsulatus*, in addition to other faecal flora.

**CASE 55.—Wound of Cæcum, Ascending Colon, and Splenic Flexure ; Localized Peritonitis.**

*Clinical History.*—Nature of wound : Gunshot wound, abdomen.

Signs and symptoms : Hit at 7.30 a.m. ; operated on at 1 p.m. A wound in the right flank perforating the cæcum and ascending colon in several places. Blood in the peritoneal cavity. The wounds were sutured. On admission, temperature 96° F., pulse 120. Next day he was comfortable ;

no vomiting ; temperature normal, pulse 110. Next day vomited a little. Bowels open with enema. Several days later bowels open daily ; no vomiting. Very little abdominal distension. Asking for morphia ; thought to be exaggerating. Next day died suddenly.

Operation : Suture of wound in cæcum and ascending colon.

Survival : Five days.

*Post-mortem Result.*—Abdomen : Stomach very much dilated ; duodenum slightly. Leakage of fæces from a pin-point perforation in the splenic flexure ; on the medial side of this, in the peritoneal cavity, but shut off from the general peritoneal cavity, was a little pus. The wounds of the ascending colon and cæcum were intact ; the mucosa in this area and in the splenic flexure was dark and septic looking, the intervening area being quite healthy. There was some retrocolic hæmorrhage. There was a track leading from behind the colon out to the wound of entrance, which was two and a half inches above the right great trochanter. Although there was no general peritonitis there were some flakes of lymph causing adhesion and partial kinking of the small bowel here and there. The loops of the small bowel hanging down into the pelvis were very much congested. The bullet could not be found.

Comments : From the nature of the bowel wounds it is probable that they were caused by the scattered fragments of bone from the ileum. The cause of death was evidently the sepsis around the leak in the splenic flexure ; the peritonitis (which may have been more general than we thought) arose from this source.

CASE 56.—Wound of Colon and Compound Fracture of Femur, with Wound of Popliteal Artery.

*Clinical History.*—Nature of wound : Gunshot wound, abdomen and thigh.

Signs and symptoms : Day after operation quite conscious ; in no pain ; abdomen soft. Pulse not yet palpable. Next day the leg was slightly swollen and numb ; slight bluish discoloration.

Operation : Laparotomy performed ; a small hole in the colon sutured. Portions of the condyles of the femur removed ; the fracture extended into the knee-joint. Carrel's tubes inserted. Intravenous saline given.

Survival : About forty-eight hours.

*Post-mortem Result.*—Abdomen : A coil of bowel was found under the skin ; it had come through the peritoneum and rectus muscle (the stitches having given way). No peritonitis.

Limbs : Leg. The popliteal artery was wounded, there being a small gap out of its wall ; it was thrombosed below this. The popliteal vein and all its branches, also the external saphenous vein, were thrombosed.

CASE 63.—Multiple Wounds (Abdomen, Buttock, and Arms). Fractured Humerus. Wounds of Small Bowel and Bladder.

*Clinical History.*—Nature of wound : Gunshot wound, arm and abdomen. (Rifle grenade.)

Signs and symptoms : Wound near the back of the left shoulder, extending down the arm ; humerus is fractured in its upper third, foreign body presumably there. Wound of right buttock, also wound of the lower abdomen to the left of the mid-line. Catheter passed, urine blood-stained. Temperature 97° F., pulse 90. Shocked, but quite conscious. The day after operation he was very ill ; temperature 97° F., pulse 140, respirations rapid ; no vomiting.

Operation : Operated on four and a half hours after being hit. Flesh wounds excised, tube inserted ; arm splinted. Median laparotomy performed in Trendelenburg position ; some blood in the peritoneal cavity, no urinous smell ; small bowel shot through in two places about two inches apart ; the bowel was excised and end-to-end anastomosis done. A through-and-through wound of the bladder near its base was discovered ; the two wounds were sutured. Operation took about an hour and a half.

Survival : About twenty-four hours.

*Post-mortem Result.*—Abdomen : The sutured bowel proved to be within a foot of the ileo-cæcal valve and was intact. The bladder suture was also intact. There was free gas in the peritoneal cavity, which came from wounds high up in the jejunum, which had not been discovered during life. Some hyperæmia of some coils of bowel.

Comments : Apparently died of shock with very early peritonitis. It is probable that if the patient had not been put in the Trendelenburg position before he was opened, the wounds of the jejunum would have been discovered at operation. But even so that would have lengthened the time of operation ; this factor probably contributed more to death than the early peritonitis.

(To be continued.)

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## Current Literature.

HARE, R. Sources of Hæmolytic Streptococcal Infection of Wounds in War. *Lancet*, January 20, 1940.

The author states that in the Great War, 1914–18, the most important bacteria infecting wounds were the *Clostridium tetani*, the gas gangrene bacilli, and hæmolytic streptococci. Tetanus was controlled by injection of serum and gas gangrene by early excision and debridement of wounds, but infection due to streptococci was not controlled at all. The source of the organisms of tetanus and gas gangrene was undoubtedly the soil over which the armies fought, but that of streptococci remained a mystery.

Recent work has shown that hæmolytic streptococci form a family divisible into groups numbered from A to K. Only one group, A, needs to be considered as pathogenic to man, the others, though often strongly hæmolytic, are rarely pathogenic. Group A may be further divided by agglutination and precipitin tests. The sources of these pathogenic strains may be pre-existing infections in the neighbourhood, the patient and his attendants, and possibly infected air, clothing, instruments and dressings, or food. A high proportion of wounds in the last war was certainly infected. The report of the U.S. Army states that a combination of hæmolytic streptococci and *Staphylococcus aureus* was the most prominent in the Base Hospital No. 15. Investigations have shown that most of the streptococcal infections of man belong to class A. Out of 1,376 strains 1,307 were placed in Group A. It may therefore be assumed that most of the wound infections in the present war will be due to strains of this group.

Many people apparently in normal health carry hæmolytic streptococci. According to Colebrook Group A strains are not found on the skin. Hæmolytic streptococci are relatively common in the nasopharynx, only a third of the numbers belong to Group A, and are pathogenic. A carrier rate of 7 per cent for these organisms is considered to be possible. Investigations of fæces showed many streptococci but these were not pathogenic, and it appears improbable that even if the wound is extensively contaminated with fæces infection by Group A strains can take place, unless there is a coincident infection of the throat. In hospitals streptococci are found in the air of infected wards and have often been shown to belong to Group A. Examination of soil from areas likely to be contaminated in Toronto did not yield any hæmolytic streptococci. It is difficult to imagine how soil could be contaminated with Group A strains. Infection of clothing with Group A strains must be unusual, except in a grossly contaminated ward.

In the last war it was found that cultures of wounds taken on arrival at the C.C.S. showed hæmolytic streptococci in 12 to 15 per cent. Most of these were probably Group A strains because Stokes and Tytler stated that 19 out of 20 wounds containing these organisms suppurated when treated by primary excision. Before arrival at the C.C.S. a wounded man can have had little contact with infected persons. But in his journey he has come in contact with 13 medical officers, 270 other ranks, and 150 patients, and as 7 per cent of normal people are carriers of Strain A in the nasopharynx he has run the gauntlet of 23 nasopharyngeal carriers and possibly 12 hand carriers. It is also possible that the wound may be infected from his own throat and hands. At the base he may be infected from his neighbours whose wounds have already suppurated. Fleming showed that strains from any of the cases in his wards were all agglutinated to titre by sera made from any one of them. Thus the evidence suggests that many infections of wounds at the base were hospital infections. Fleming and Porteus found that when the patient had been kept at the C.C.S. for more than three or four days, *Streptococcus pyogenes* was present in nearly every case. When



the patient was sent straight on to the base *Str. pyogenes* was found in only 15 out of 75 cases. After a stay of over a week at the base 90 per cent. were found to have *Str. pyogenes* in their wounds.

The evidence suggests that hæmolytic streptococci which infect wounds before the men arrive at the C.C.S. are exogenous and probably derived from the nasopharynx of someone in attendance. Hare suggests that two lines of attack may be followed to reduce the incidence of these infections. The first should be to prevent the transfer of micro-organisms from the hands of every person from regimental aid post to base hospital. The ideal would be that every person who attends to a wound should be efficiently masked and wear sterile gloves. At least masks might be worn by all attendants. Sterile rubber gloves in forward areas may be impracticable, but gloves moistened with adequate antiseptic would do as well.

The second line of attack consists in the segregation of infected cases. A medical officer conversant with modern methods of isolation and classification of the hæmolytic streptococci on the staff of a base hospital would undoubtedly be of assistance, but his recommendations about isolation must be acted on by the medical officers in charge of the cases. The most efficient prophylactic measures in the forward areas may be completely nullified by their non-adoption at the base.

#### **Excision of War Wounds. *Lancet*. February 3, 1940.**

In the annotations in *The Lancet* there is an account of the suggestion of Roux and Leriche, who watched the evolution of the methods of treating wounds in 1914–18. They believe that in the present war the treatment of wounds will be in the hands of the younger surgeons who have had no war experience and may not operate with the rigour that in 1918 was considered essential, and may put too much faith in chemotherapy. There is a respite of about twelve hours before infection sets in, and if the wound can be operated on within this period there is a chance that it will heal cleanly. Antiseptics play no part in the régime.

Leriche considers that if primary excision has been skilfully carried out the wound can be encased in plaster, but he does not agree that it is the ideal method for all wounds of soft parts. All deep wounds of muscle should be left open, and if after fifty-four hours the wound is clean, secondary suture may be done.

Roux describes the stages in which excision should be carried out. Hæmostasis should be perfect so that no blood-clots are left in the depth of the wound. Two sets of gloves and instruments should be used, the first set being discarded when the initial cleaning up is finished. Liquid soap is used for cleaning; the soap is removed with sterile water and ether used to remove grease. Iodine is painted on the skin only. The second stage consists in excision of the skin edges. The knife is kept perpendicular and if possible  $\frac{1}{2}$  to 1 cm. removed from the skin in one piece without the knife being allowed to enter the depth of the wound. No subcutaneous

dead space must be left. If the skin is undermined it must be opened up by branch incision or counter drained. Next the aponeurosis is excised with scissors, leaving a smooth continuous edge. The fourth stage consists in the removal of foreign bodies and of damaged muscle. All injured or ischæmic tissue should be removed, but excessive mutilation should be avoided. The cavity of the wound should never be curetted. The foreign body, the tissues enclosing it, and those which it has traversed, should be removed *en bloc*. When important structures such as nerves or vessels are in the depth of the wound these should be seen. When there is an entrance and exit wound, these, if superficial, should be excised. When the two orifices are far apart or when the tract goes through inaccessible parts, entrance and exit wounds should be excised and drainage left for the deeper part of tract. Under no circumstances must through drainage be promoted by drawing gauze through on the end of forceps, or by irrigation under force. Leriche says that wounds should never be closed by primary suture if they involve large vessels, if they have gone through the middle of a deeply placed bone, or if they have traversed the substance of a muscle where the surgeon can never be sure of satisfactory excision. Every stage of the operation must be carried out definitely and directly and under direct vision.

SAVAGE, SIR WILLIAM. **Canned Foods in Relation to Health.** *Lancet*, November 4, and *Public Health*, February, 1940.

Sir William Savage has performed a service by contributing to *The Lancet* of November 4 an article entitled "Canned Foods in Relation to Health," in which he discusses and gives an authoritative pronouncement on every aspect of the subject.

Over 350 different commodities are marketed. Home production is now considerable but, apart from milk and vegetables, 85 to 90 per cent of canned foods consumed in this country are imported. In 1937, imports exceeded 10 million hundredweights.

Very high standards of cleanliness and care in production are essential if unsoundness and, therefore, economic losses are to be avoided. The author considers three health problems in relation to canned foods : (1) Is the nutritive value adversely affected ? (2) Are any chemical substances prejudicial to health added in the preparation of the food or from the container ? (3) Are such foods more liable than similar fresh foods to cause or convey disease of bacterial origin ?

On the nutritive side canned foods compare favourably with cooked, fresh foods, even as regards their vitamin content. Vitamin A is insoluble in water and heat stable in the absence of oxygen, so that canning is less destructive of this vitamin than ordinary cooking. Vitamin B<sub>2</sub> complex is very heat stable and is water soluble. The only loss, therefore, is in the preliminary washing. Vitamin D is heat stable and there is no destruction in canning. Vitamin B<sub>1</sub> is water soluble but has considerable resistance to

heat in an ordinary acid medium. There is some loss in canning, but not more than in domestic cooking. Vitamin C is readily affected by heat, washing, and storage; therefore all cooking processes, whether domestic or canning, cause material loss of vitamin C, and a high vitamin-C intake can only be obtained from fresh, uncooked foods. But many canned fruits and vegetables have an adequate amount and canning is not more prejudicial to the vitamin-C content than ordinary cooking.

As regards chemical contamination, the author has been continuously on the lookout for cases of tin poisoning, both in the literature and in his own experience, and has only come across one possible case, which was associated with a 3-year-old consignment of tinned apricots where the tin content reached the quite exceptional figure of 5.6 to 8.8 grains per pound. As regards lead, the modern can needs a minimum amount of solder, and in the few instances where abnormal quantities of lead have been found, the fault has been in some stage of the preparation of the food before canning.

Canned foods, in common with all other foods, have been responsible for three kinds of food poisoning, viz. botulism, infection with living bacteria of food-poisoning type, and the toxin type of outbreak. No cases of botulism have occurred in Great Britain from tinned foods, and though formerly outbreaks occurred in certain parts of the U.S.A., scientific investigation and careful control of processing temperatures have now eliminated all risk from commercially canned foods.

Canned foods play a very minor part in outbreaks of illness due to infection with living food-poisoning type bacilli, and undoubtedly these foods are very much safer in this respect than ordinary foods. In the toxin type of food poisoning, canned foods are more often the vehicle, because though the processing temperatures are sufficient to kill the bacilli, they do not always destroy the pre-formed toxins. Fortunately the case mortality of this type of poisoning is very low, less than 0.5 per cent. The number of outbreaks associated with canned foods is decreasing. They now very rarely occur from corned beef and arise mostly from fish products.

After considering all the data, the author is of the opinion that as a source of food poisoning, canned foods are at the present time definitely safer than ordinary foods. Medical officers of health will no doubt welcome such clear and definite statements from one whom they have long recognized as an authority on all questions of food in relation to health.

**SLAUGHTER, W. B. Lymphogranuloma Venereum, with Special Reference to Head and Neck Lesions.** Collective Review. *Surgery, Gynaecology and Obstetrics with International Abstract of Surgery*. 1940, v. 70, No. 1, 43-51 [97 refs.].

In this review Slaughter draws attention to the protean manifestations of this disease which exist under a wide variety of names, and points out that though it occurs in all parts of the world its existence is often overlooked;

there is little doubt that it is far from uncommon in America, especially amongst the coloured population.

The causal organism is an ultra-microscopic filtrable virus which sets up pathological changes characterized by giant-cell formation and reticulo-endothelial hyperplasia.

Diagnosis depends chiefly on the Frei test and treatment is very unsatisfactory; the most promising results have been obtained with Frei antigen given intracutaneously or intravenously. (No mention is made of the sulphonamides which have recently been reported as giving encouraging results.) There is a comprehensive bibliography. T. E. O.

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## Reviews.

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**SYNOPSIS OF SURGERY.** Eleventh Edition. By Ernest W. Hey Groves, M.S., M.D., B.Sc.Lond., F.R.C.S.Eng. Bristol: John Wright and Sons, Ltd. 1940. Pp. viii + 714. 195 illustrations. Price 17s. 6d.

The tenth edition of this book was reviewed in the Journal in December, 1933. It requires no fresh introduction. The new edition has been brought up to date by the inclusion of Böhler's technique in the treatment of fractures and the addition of a chapter on surgical treatment of fractures of the neck of the femur.

For revision of the large and growing subject of surgery it is an excellent book of ready reference.

**TREATMENT BY MANIPULATION.** By H. Jackson Burrows, M.D., F.R.C.S., and W. D. Coltart, M.B., F.R.C.S. London: Eyre and Spottiswoode, Ltd. 1939. Pp. xii + 36. Price 5s.

A useful little book for "many members of the medical profession (who may) know too little of the selection of cases for manipulation, its technique, and the results which may be expected from it." D. C. M.

**A POCKET MEDICAL DICTIONARY.** Fourth Edition. Compiled by Lois Oakes, S.R.N., D.N.Lond.&Leeds, assisted by Thos. B. Davie, B.A., M.D.Lpool. Edinburgh: E. and S. Livingstone. 1940. Pp. xix + 409. Price 3s. 6d.

This small dictionary, now in its fourth edition, is evidently fulfilling its purpose of being useful to medical students during their early years. It will probably be found of most service to the student commencing his clinical studies. Only two years have elapsed since the publication of the previous edition, and in the present edition a useful Appendix on First Aid has been added.

ENGLISH, GERMAN, FRENCH, ITALIAN, SPANISH MEDICAL VOCABULARY  
AND PHRASES. By Joseph S. F. Marie. London: J. and A.  
Churchill, Ltd. Price 12s. 6d.

Chevalier Jackson, in his foreword to this very excellent and essentially practical polyglot medical vocabulary, voices the sentiment of many amongst us when he says: "All my life I have wanted just such a book as this. It makes me sad to think of the thousands of weary hours it would have saved me, hours spent in handling a clumsy stack of dictionaries of different languages. . . ."

In these war days such a book should be especially useful to those amongst us whose duty or pleasure it is to plough through the maze of enemy as well as of allied medical literature.

On all these scores the book is thoroughly to be recommended. S. S.

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## Correspondence.

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### CHARTERHOUSE RHEUMATISM CLINIC.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—I would be glad of the hospitality of your columns to make it known that all medical officers of the three Services, who may desire to treat rheumatic personnel by the standard method of the Charterhouse Rheumatism Clinic, can obtain supplies of the vaccine used at that institution free of charge on application by letter to the Secretary, The Charterhouse Rheumatism Clinic, 56-60, Weymouth Street, London, W.1. When writing it would be of great assistance if medical officers were to mention their previous experience, if any, in the use of our methods.

56-60, *Weymouth Street*,  
*London, W.1.*  
*February 15, 1940.*

I am, etc.,  
ELLERT FORBES, *Major*,  
*Secretary.*

---

## Notices.

---

### "TABLOID" "EMOCIN" THROAT LOZENGE.

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CHADWICK PUBLIC LECTURES, MARCH TO JUNE, 1940.

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Date and Time	Place	Lecturer	Subject	Chairman
1940. March Tuesday, 12th, 2.30 p.m.	LONDON: The Livingstone Hall, London Missionary Society, 42, Broadway, Westminster, S.W.1 (Opposite St. James's Park Station)	T. N. V. Potts, Esq., M.D., B.S., D.P.H., County Medical Officer of Health, West Riding of Yorkshire	The Role of Women in the Public Health Service To-day	Miss Zoë Puxley, O.B.E., A Chadwick Trustee.
April Tuesday, 9th, 2.30 p.m.	The Royal Society of Tropical Medicine and Hygiene, 26, Portland Place, W.1	BOSSOM GIFT William H. Hamlyn, Esq., F.R.I.B.A., Principal Architect, L.M.S. Railway Company	LECTURE Camps : Their Design, Con- struction and Hygienic Arrangement	Alfred C. Bossom, Esq., F.R.I.B.A., M.P.
May Tuesday, 21st, 2.30 p.m.	The London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1	Professor S. P. Bedson, M.D., M.Sc., F.R.S.	Human Virus Infections of Animal Origin : Their Mode of Spread and Control	Sir George W. Humphreys, K.B.E., M.Inst.C.E., Vice- Chairman of the Chadwick Trustees.
June Thursday, 20th, 4 p.m.	The Chelsea Physic Garden, Swan Walk, Chelsea, S.W.3	Professor William Brown, D.Sc., M.A., F.R.S.	Plant Disease in Relation to the Public	Sir William J. Collins, K.C.V.O., M.D., M.S., B.Sc., F.R.C.S., Chairman of the Chadwick Trustees.

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### EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

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Communications in regard to editorial business should be addressed— "The Editor, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, A.M.D.5, Thames House, No. 3, Millbank, S.W. 1."

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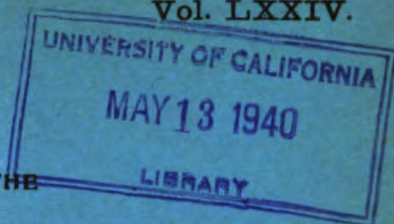
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Vol. LXXIV.

# Journal

OF

THE



## Royal Army Medical Corps



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MONTHLY

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### CONTENTS

	PAGE		PAGE
<b>ORIGINAL COMMUNICATIONS.</b>		<b>CLINICAL AND OTHER NOTES.</b>	
British Medical Society of the Dieppe Area. . . . .	185	Six Cases of Cerebrospinal Meningitis Treated with M & B 693, Military Isolation Hospital, Aldershot. By Major L. R. H. KEATINGE, R.A.M.C. . . . .	223
(1) President's Address . . . . .	186	Intensive Treatment of Gonorrhœa with M & B 693. By Major T. P. BUIST, R.A.M.C., and Captain R. H. SIMON, R.A.M.C. . . . .	229
(2) Some Reflections on the Development of War Surgery. By Colonel C. MAX-PAGE, D.S.O. . . . .	192	A Case of Severe Generalized Dermatitis Treated by Sulphonamide. By ETHEL BROWNING, M.D. . . . .	231
(3) Chemotherapy in Relation to War Wounds. By Colonel L. COLEBROOK, and discussion . . . . .	197	<b>ECHOES OF THE PAST.</b>	
Surgical Rearmament. By Lieutenant-Colonel D. C. MONRO, M.B., Ch.B., F.R.C.S.Ed., R.A.M.C. . . . .	205	Twenty Years After. By H. SKIPTON STACY, M.D., Ch.M.(Syd.), F.R.A.C.S. . . . .	235
Extracts from the Memorandum on Cerebrospinal Fever among Troops . . . . .	212	CURRENT LITERATURE . . . . .	239
<b>EDITORIAL.</b>		REVIEWS . . . . .	242
Trench Fever . . . . .	216	CORRESPONDENCE . . . . .	246

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# Journal of the Royal Army Medical Corps.

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## Original Communications.

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### BRITISH MEDICAL SOCIETY OF THE DIEPPE AREA.

THE inaugural meeting of the Society was held on Friday, November 10, 1939, in the Grand Hotel, Dieppe. About eighty officers were present when the Chair was taken at 4 p.m. by Major-General R. Priest, K.H.P., Consulting Physician to the B.E.F.

After very briefly outlining the aims of the Society the Chairman suggested that it should be officially created, and that there should be elected the necessary officials and a committee representing the medical units and dental services in the Medical Base Sub-Area.

The following was the result of the election :—

#### *President :*

Major-General R. Priest, K.H.P.,  
Consulting Physician to the B.E.F.  
Proposed by Colonel C. Max-Page.  
Seconded by Colonel J. M. Weddell.

#### *Vice-Presidents :*

Colonel C. Max-Page, D.S.O.,  
Consulting Surgeon to the B.E.F.  
Proposed by Colonel S. G. Walker,  
Seconded by Colonel A. L. Foster.  
Colonel G. Wilson, O.B.E.,  
Commandant of the Medical Base Sub-Area.  
Proposed by Colonel C. Max-Page,  
Seconded by Lieutenant-Colonel L. W. Proger.  
Colonel S. G. Walker.  
Proposed by Colonel A. L. Foster.  
Seconded by Colonel T. S. Blackwell.

Colonel J. M. Weddell, Consulting Surgeon to the B.E.F., who had been the first nomination as Vice-President, regretted his inability to undertake office in view of the fact that he would shortly be leaving the area.

*Hon. Secretary :*

Major R. B. Myles, *O.B.E.*, *R.A.M.C.*

Proposed by the Chair and generally approved.

## PRESIDENTIAL ADDRESS, November 22, 1939.

BY MAJOR-GENERAL ROBERT PRIEST, *K.H.P.*

MR. CHAIRMAN AND GENTLEMEN,—This afternoon I crave your indulgence while I give you a review of the medical situation during the years that have intervened between the last war and the commencement of this, and a preview of the task that is before us. The review must of necessity be short and incomplete, while the preview must likewise be somewhat specific.

During the last twenty-five years there have been great changes in the Army itself, for no longer are the roads filled with large bodies of troops heavily laden with their equipment marching with a song to their objective, with long lines of slow-moving horsed transport ; on the contrary, the men are few and are seen to be marching in small scattered groups, while transport consists of fast-moving, petrol-driven vehicles and mechanical monsters, the names of some of which I must confess I am ignorant.

In like manner have the Army Medical Services progressed with the times, and they are now more able to cope with the medical problems of a campaign than ever before, by virtue of increased professional and administrative knowledge and of the provisions of a full and up-to-date equipment. In the intervening years the training of all branches of our Medical Services has been intensified, and every officer has been encouraged not only to follow his particular bent, but in addition to acquire those higher qualifications which are so necessary for specialist practice. The Regular Medical Service, as is well known, is sufficient for our peace-time defence forces, but when war breaks out, it is joined by our experienced officers from the Reserves, the Territorial Army, and our colleagues from civil practice to attack the vital problems of wounds and disease. Of surgery I feel I am not fully competent to say much, but it is legitimate, I think, to forecast that modern warfare will produce different kinds of wounds, the treatment of which I trust we shall learn from subsequent lecturers. But this I do know, that there are special hospitals in the United Kingdom already prepared to receive wounds of the head, chest, fractures, facio-maxillary injuries, and there are also limb-fitting centres. As you may remember, in the last Great War these special hospitals took some time to be formed. Tetanus is robbed of much of its terror by the introduction of prophylactic injections of toxoid and by the prophylactic and therapeutic injections of serum.

Of medicine I feel more competent to treat. Firstly our cardiological problems have become very much simplified by the clinical researches of

Mackenzie, of Sir Thomas Lewis and others, and by the introduction of the electrocardiograph. Thanks to Colonel Beatty there is an electrocardiograph with this Force, which will very soon be available for use at the Blood Transfusion Laboratory. With all these aids we are able to form an opinion as to which men can remain in the Service and which should be invalidated, and further we are able to differentiate the irregularities of action that matter from those that do not. The digitalis therapy of cardiac failure has been put on a scientific basis and the introduction of the intravenous and suppositorial methods of administration of the mercurial diuretics has been of great help in rapidly reducing the oedema of cardiac failure. They should, however, be used cautiously, when we remember how soon after the introduction of these substances a famous man finding that, in the matter of urination, the result was not in keeping with the effort expended, called his physician to his side and implored his help. This physician, seeing that his illustrious patient was pale, very obese, flabby, and possessed of a moist skin, decided to give him an injection of one of these mercurial diuretics by the intravenous route. The result was immediately eminently successful, but history does not relate how many injections were administered. In a short time, however, he began to complain of toothache and tenderness of his teeth. The offending teeth were removed by his dentist. Then followed in turn an acute gingivitis, septic stomatitis, nephritis of perhaps septic origin superimposed upon the accumulative effects of the mercury, so that the patient succumbed.

In the field of gastrology some of our military problems have been solved by the introduction of the fractional test meal of Bennet and Ryle, by the barium meal, screening and periodic X-ray photographs, and the chemical test for occult blood in the stools. The gastroscope has also been called in to help.

No longer shall we see the wasted, living skeletons trying to enjoy their miserable lives on the starvation diet at one time recommended for diabetes, a diet which consisted in its early stages of cabbage and cabbage water, and when a change was requested by the patient, he received spinach and spinach water. No longer do those patients in diabetic coma invariably slip from our grasp. On the contrary, more diabetics of all grades of severity are now returned to a useful state of health by a mixed diet containing liberal carbohydrates controlled by injections of a slow-acting insulin. Of course a soldier cannot be regarded as fit for service under these conditions, but we have had before us at the War Office Medical Boards certificates from medical officers, civil and military, to the effect that an officer suffering from diabetes, taking a liberal diet plus insulin, is fit for general service. It should be remembered that the term "general service" means service at home or abroad in peace or in war. In peace-time, if an officer is not fit for all these duties, the Medical Board has no alternative but to mark him unfit and to recommend leave. But if the War Office ask a Medical Board to answer the question "Is such an officer fit for a special appointment at home?" the

Board may, if they think the officer can remain in this balanced state with ease, find him fit for such a duty. On active service, on the other hand, the syringe may break, the needle become lost, sterilization difficult, the insulin supply may run short, and the correct diet difficult to obtain.

Of the deficiency diseases, pernicious or Addisonian anæmia is robbed of its immediate fatality by the introduction of liver therapy, while scurvy, beri-beri, and pellagra, are practically non-existent in our armed forces. But there are certain occasions in peace and war when scurvy or beri-beri is likely to appear. Occasionally, two or three men get detailed for some duty in an isolated store perhaps well away from their unit, and are given ration allowance instead of the actual ration. With a view to saving money a man may elect to live on tea, bread, margarine, bovril, and chewing gum, and sooner or later one or the other condition may develop.

In peace time, scurvy usually comes into the medical wards through the dentist's chair, either because the dental officer is familiar with the very characteristic appearance of the gums or, being unfamiliar with it, has sought the advice of a physician. The diagnosis is easily confirmed by undressing the patients, where in some part of the skin we shall see the tell-tale hæmorrhages and the small hæmorrhages round about the hair follicles. The buds and daughter-buds in the gums giving that peculiar plum-coloured irregularity to the gums, the ease with which they bleed, and the loosening of some of the teeth, form a characteristic picture.

Diphtheria has really no terror, and the number of tracheotomies gets fewer and fewer. The Schick test separates immunes from susceptibles, and the latter can now be immunized by the T.A.F. method. Scarlet fever, which used to cause whole battalions and hospital wards to be put into quarantine, is now very mild and by the Dick test the immunes can be sent back to duty. The others may also be sent back to their units with a note to the medical officers concerned informing them that the men are contacts needing daily inspection until the full quarantine period is passed.

The introduction of artificial pneumothorax has served to arrest the progress of tuberculosis of the lung, especially in those instances where men have to remain for a considerable time abroad before a steamer becomes available to take them to the United Kingdom.

No list would be complete if no mention were made of chemotherapy. For the treatment of the occasional case of malaria we shall have atabrin of the acridine series and plasmoquine of the quinolin group. Our officers in India have devised a very efficient course of therapy with these drugs; the doses of plasmoquine given are non-toxic and should not be exceeded because if larger doses are used, necrosis of the liver is likely to follow.

M & B 693 has come to our rescue in the treatment of cerebrospinal fever and has greatly reduced the mortality; in the pneumonias, too, our anxieties have been allayed, and I hope the statistics will show a reduction of the mortality which in the Army has remained for many years past between 9 and 12 per cent. Streptococcal sore throat known to our forebears as

malignant angina or putrid sore throat, if taken in time, responds rapidly to this amazing compound.

Of the pathological and biochemical tests there is not time to treat except to remark upon the inestimable value we have gained from them and from the estimations of blood-sugar, blood urea, uric acid, and blood calcium. I have already mentioned the use of opaque substances and X-ray in diagnosis.

After this lengthy enumeration it might be remarked, What else is there to do ? To which I would reply, Gentlemen, there is yet plenty to do. In war-time the study and practice of preventive medicine becomes all-important. If we know the cause, and the means of spread of disease, we shall the better know how to prevent its occurrence and so save an enormous loss of man-power. First as regards those diseases that are spread by infected food, fly-carriage, unclean fingers, and unwashed fruit ; these are the dysenteries and the fevers of enteric, abortus, and melitensis groups. Dysentery or "the bloody flux," has decimated armies in the past and has brought many campaigns to a close. Dysentery in the Army refers to amœbic (protozoal) and bacillary dysentery, the organisms being the *Entamoeba histolytica* in the first case and the bacillus of Shiga, the organism of Flexner, Sonne and Schmidt, etc., in the second. Every effort must be made to destroy the fly in all stages of its development and to instil clean habits into those who handle food, and above all to prevent access of flies to food and drink. We are all acquainted with the prophylaxis of the enteric group and we know that the abortus and melitensis infections can be eliminated by boiling all milk. In this country a large percentage of milk supplies is contaminated by the *Brucella abortus*.

The next group which I must mention consists of trench fever, relapsing fever, and typhus fever. These are spread from man to man by the body louse. Trench fever is characterized by a fairly sudden onset, a reddening of the conjunctiva, a fever of irregular or recurrent nature, in some cases a crop of rose-spots, enlargement of the spleen and persistent and troublesome pains in the limbs, especially along the shins. The fæces of the louse contain the virus, and this becomes rubbed into the puncture made by the louse-bite.

Relapsing fever is due to the *Treponema recurrentis*, which can be found in the stained blood-film, and is characterized by periodic waves of fever. It is easily cured by two or three injections of N.A.B. We shall not, I think, meet with cases of typhus fever in this Force, but it might appear amongst prisoners of war who have seen service recently in the more eastern parts of Europe. It is a toxæmic, prostrating fever, with death in severe cases within the first eight days ; most cases show the fairly characteristic mixed or so-called "mulberry" rash, and one of the best features happens on or about the fourteenth day when the fever falls by rapid lysis or crisis, the patient suddenly changes for the better and takes an interest in his food and surroundings. The Weil-Felix test with *Proteus* organisms OX19, OXK, and OX2 should be carried out at five-day intervals throughout the illness.



The louse is a true parasite of man ; if the temperature of the host rises as in some febrile state, probably caused by the louse itself, or when the surface of the body cools, the louse immediately evacuates the host to seek pastures new. Have we not been told by MacArthur how the chroniclers of the past related that after Thomas à Becket had been murdered and as his body lay growing cold, there issued from his clothing lice in such innumerable numbers that they resembled a simmering cauldron ?

It is therefore of paramount importance that officers in charge of units should see that their troops are kept free from louse infestation.

We shall meet with another group of diseases in the form of jaundice, of which there are three types commonly seen in armies in the field : the (epidemic) catarrhal, the infective, and icterus hæmorrhagica (Weil's disease). Weil's disease, due to an infection by the *Leptospira ictero-hæmorrhagiæ*, will nearly always show much more constitutional signs and will exhibit hæmorrhage in some form or other, most frequently perhaps in the urine. The rat is the reservoir of the causative organism.

Rat-bite Fever : The initial bite heals well, but in about five weeks' time the original wound breaks down and ulcerates ; there is some concomitant lymphangitis, and as the disease progresses other inflammatory areas appear in the skin which also break down and ulcerate ; from these, too, the causative organism, the *Spirillum minus*, can be identified in the stained blood-film. The fever tends to recur at fairly regular intervals. It is easily cured by two or three injections of N.A.B.

There is a form of typhus fever which is transmitted from the rat to man by the common rat-flea, *Xenopsylla cheopis*. The infection appears to run a milder course than classical typhus, but the serum of the patient agglutinates the same *Proteus* organism, OX19.

I do not think we shall see instances of plague except as an extreme rarity at or near one of the ports, and I mention it only in passing. The occupation of farm buildings, barns, and farm-land by troops in trenches, brings man into much closer contact than usual with the rat, and modern warfare disturbs the usual habits of the rodent, causing much more migration and consequent carriage of infection from one area to another. It is said that the migration of rats must be seen to be believed, for we are told that in London when workmen were repairing the Fleet sewer, rats migrated in such myriads that traffic was held up in the region of Ludgate Circus for a very considerable period of time. From these remarks it will be very easily gathered how important it is that an active campaign should be waged against this rodent enemy.

It must not be forgotten that there may be sporadic cases of rabies and therefore all cases of dog-bite should be treated with seriousness. The offending dog should not be destroyed but should be chained up in isolation for ten days. If the dog survives beyond this period, the animal is not rabid. In case of doubt or necessity, patients can be sent to the nearest centre for treatment. The addresses of these centres have appeared in Orders.

Regarding smallpox we must remember that with this Force we have individuals completely protected by vaccination, some unprotected by virtue of never having been vaccinated or of not being vaccinated since infancy, and some who are partially protected. This being so we must keep a careful look-out for cases of smallpox by regarding every case of doubtful chicken-pox with suspicion, and be specially on the look-out for the very infectious and fatal hæmorrhagic form—*purpura variolosa*—a truly loathsome form of the disease. The rash appears as a punctate erythema either in the axillary region or in the groins, soon spreading all over the body and rapidly becoming purpuric. The skin becomes plum-coloured and soon commences to bleed, as also do the mucous membranes of the mouth, bladder, and bowel. The subconjunctival hæmorrhage makes the cornea appear as a depression in the eye.

There are many reservists in this Force who have served abroad in India and China. Should any of these exhibit signs of mental disease accompanied or unaccompanied by seizures of an epileptiform nature, or exhibit epileptiform attacks, we should always think of the conditions known as cysticercosis, where man, instead of the pig, has become the intermediate host of the *Tænia solium*.

I think I have said sufficient to show that there is yet much to do in our endeavour to overcome our greatest enemy—disease, and I am sure the *Proceedings* of this newly formed Medical Society will very materially help us in our common task.

In conclusion, I should like to quote from the writings of John of Mirfield, one of the three British pioneers of medicine and surgery in the middle of the fourteenth century: "Modern physicians possess three special qualifications, to be able to lie in a subtle manner, to show an outward honesty, and to kill with audacity." But the same author tones down this sweeping allegation by subsequently writing: "Long ago, unless I mistake, physicians used to practise surgery, but nowadays there is a great distinction between surgery and medicine and this arises, I fear, from pride because the physicians disdain to use their hands, though indeed I myself have a suspicion that it is because they do not know how to perform a particular operation. This unfortunate usage has led the public to believe that a man cannot know both subjects, but the well informed are aware that a man cannot be a good physician who neglects every part of surgery and on the contrary a surgeon is good for little who is without a knowledge of medicine."

So, Gentlemen, we are gathered together this afternoon as a Medical Society, each with his own outlook on the practice of his own branch of the profession, yet all the same we have but one object in common, and that is by the interchange of our knowledge and experience at these meetings to further the art and science of Military Medicine as much as, if not more than, any other medical service in the world. Let us then depart in peace and harmony, and as Harvey said, "Let us continue to search out the hidden mysteries of Nature."

## MEDICAL SOCIETY, DIEPPE AREA.

### SOME REFLECTIONS ON THE DEVELOPMENT OF WAR SURGERY.

BY COLONEL C. MAX-PAGE, D.S.O.

ON the military side this war is so slow in development that we have much time in which to consider what we should do and how we should do it when the clash comes. I may therefore be excused if I go back in the surgical calendar and survey briefly the development of our craft in relation to war.

It will, I think be admitted that a knowledge of traumatic surgery was first forced on man by fighting of the same sort. The surgery of wounds provided the school material in which our art developed. Experience of it coloured the whole of surgical practice until a relatively recent date, and in scientific era the military surgeon has continued to contribute materially to our knowledge and technique.

Without venturing into speculations on the sources of surgical knowledge exposed in the Hippocratic treatises, I may remind you that Galen, whose ingenious anatomical and physiological theories dominated and sterilized medicine from the third century till the era of Fabricius and Harvey, served his apprenticeship to medicine as Medical Officer in Charge of the Gladiatorial School at Pergamum. While there, he initiated the treatment of wounds with an absorbent dressing soaked in wine and reported excellent results. He stated that in his four years of office no gladiator died while under his care.

About the same period the Roman Army established a legionary medical service. The surgeons serving in this organization were of poor education and of low social status. No written records of their work have been found, but to judge by the instruments they employed they must have reached considerable technical efficiency. They may be credited at any rate with the introduction of the all-metal artificial limb if one may judge by the fine bronze specimen to be seen in the museum of the Royal College of Surgeons.

After the collapse in Europe of the western empire the resulting cloud of bigotry and ignorance involved all branches of medicine until the twelfth or thirteenth century. During this period there is no record of sound practice or any suggestion of any progress in surgery. It is true that the flame of medical knowledge was kept alight by the Arabic school, but the subject of surgery was neglected owing to religious prejudices. A re-awakening of intellectual life, and with it a thrust to free surgery from the jealousy and reactionary attitude of the physicians and clerics, came in the fourteenth century. This movement may be attributed in no small degree to the realistic experience of practical surgeons in the frequent wars of the period.

Henry de Mondeville (1260-1320) had a surprisingly modern outlook.

and his successor, Guy de Chaliac, published his "*Grande Chirurgie*" in 1363. This work remained the classical treatise on the subject up to the time of Paré. In it is described the treatment of fractures of the femur by traction over a pulley, the limb being supported by bolsters. The method appears to me to be the same in principle as that adopted at the present time in one of our specialized units. John Arderne, a contemporary of Guy de Chaliac, is the first English surgeon to find a place in the literature. He was a pupil of the Salerno School and had extensive active service in the Hundred Years' War. On his return to England after the Battle of Crécy he set up in practice at Newark and his services were much sought after. In his retirement he wrote a textbook and introduced to England an operation for fistula, much as it is practised to-day.

The extended use of fire-arms which took place in the fifteenth and sixteenth centuries introduced a new complication in wound treatment. It is easy to understand that the soft low-velocity missile of those days was often associated with the retention of the bullet. Taking into consideration the low standard of personal hygiene a gross mixed infection must have resulted from almost every gunshot wound. It is, therefore, not surprising that John of Vigo and others propounded the theory that gunshot wounds were poisoned and should be treated accordingly.

The method devised and adopted on this theory was to treat the wound with the actual cautery or boiling oil. It was not until 1536 that Ambrose Paré illustrated the unsatisfactory nature of this treatment and reverted to the use of simple and harmless dressing for all gunshot wounds. Ambrose Paré is the most striking figure in the middle period of surgical history and his direct and common-sense reasoning effected great advances in the art. He was a man of humble extraction and moderate education, and wrote all his medical treatises in the vernacular. This was of great advantage to the practising surgeons who were often not Latin scholars, but roused great enmity among the physicians of his period. He entered the army service at the age of 19 and subsequently became Army Surgeon in succession to Henri II, Francis II, and Charles IV. His account of his experience which led him to discard the cauterization of wounds is worth repeating.

"In the year of our Lord (1536) I was in the King's Army, the surgeon of Monsieur Montejan, General of the Foot. I will tell the truth : I was not very expert at that time in matters of Surgery [he was 26 or 27 years old], nor was I used to dress wounds made by Gunshot. Now I had read in John of Vigo that wounds made by Gunshot were venenate or poisoned, and that by reason of the gunpowder. Wherefore for their cure it was expedient to burn or cauterize them with oil of Elders scalding hot with a little treacle mixed therewith. It chanced on a time that by reason of the multitude that were hurt I wanted this oil. Now because there were some few left to be dressed I was forced, that I might seem to want nothing and that I might not leave them undressed, to apply a digestive made of yolk of an egg, oil of Roses and turpentine. I could not sleep all that night for I was

troubled in mind, and the dressing of the previous day (which I judged unfit) troubled my thoughts, and I feared that the next day I should find them dead or at the point of death by the poison of the wound, whom I had not dressed with the scalding oil. Therefore I rose early in the morning, I visited my patients and beyond expectation I found such as I had dressed with a digestive only, free from vehemence of pain, to have had a good rest and that the wounds were not inflamed nor tumified. But on the contrary, the others that were burnt with the scalding oil were feverish, tormented with much pain, and the parts about their wounds were swollen. When I had many times tried this in divers others I thought this much, that neither I nor any other should ever cauterize any wounded with gunshot."

Later in his career he reintroduced the ligature for the control of hæmorrhage. It is interesting to note that it was a century or more before the value of this method became generally recognized. In his published works on surgery and midwifery his description and the figures illustrating the reduction of dislocations is remarkably up to date. The use of massage was also introduced to Europe by him.

In the seventeenth and eighteenth centuries no outstanding surgical progress was made in the military field, but the work of two Service men calls for mention. James Lind (1716-94) was a naval surgeon who took an interest in nutritional questions. He published a book entitled "On the most effective method of procuring the health of Seamen." That hard-headed Yorkshireman Thomas Cooke read this book and adopted its principles on his voyages in the Pacific. He records that he had but one death in a crew of 118 men during the voyage and attributed this low mortality to the régime advised by Lind.

John Pringle (1707-82) was an Army doctor who may be regarded as the father of modern hygiene. He drew up rules for the placing of camps and for the control of enteric diseases in hospitals and gaols. His conclusions were based on sound common sense and were little altered till the latter part of the scientific era.

The Peninsular War brought into prominence several British surgeons, and Thomas Guthrie (1760-1842) may be mentioned as one of the more prominent ones. He wrote a book on gunshot wounds but, on his return to London he became, oddly enough, a prominent ophthalmic surgeon. In the Napoleonic period the most outstanding figure in surgery was Larrey. He accompanied Napoleon on nearly all his campaigns as his personal surgeon. He also took a big part, however, in the organization of the French Army Medical Service and was created a Baron. He was evidently a practical man as he introduced the use of plaster of Paris for splintage, and the scultet or many-tailed bandage.

The Crimean War cannot be said to have brought much credit to the English Army Medical Service. It will, however, remain a landmark in medical history on account of its having given Florence Nightingale the chance to develop her work and lay the foundations of our modern nursing

service. In the technical field Spencer Wells, working at Smyrna, introduced his classical artery forceps and Gamgee, at Malta, the absorbent dressing which is still associated with his name.

The Franco-Prussian War was of such short duration that little opportunity was offered for the proving of new ideas, but it is of interest to note that German surgeons employed the newly introduced Listerian method in the treatment of compound fractures.

The Boer War, despite its relatively long course, did not afford a great deal of surgical experience. The official figures give some measure of the preponderance of medical problems. In the first year the admission per 1,000 head of troops was 130 sick and 48 wounded. The relative mortality for medical and surgical cases was 18·1 and 2·9. The introduction of T.A.B. vaccine by Sir A. Wright was the outstanding medical contribution to this campaign and reduced the typhoid problem in the second year to manageable proportions. The conclusions of the surgeons working in South Africa were entirely conservative in their direction. This arose from the fact that the effective missiles were most frequently Mauser rifle bullets and because the campaign was carried out in uncultivated soil. So little suppuration was observed that no special means were taken to combat it.

The surgery of the Great War interests us most closely, and it is worthy of notice how the conservatism derived from South African experience controlled the handling of wounds in France in its early part. Its failure under the conditions then experienced was soon recognized, but it was a year or more before a sound remedy was found. It took longer still to free the profession from a faith in the value of chemicals applied to the surface of a wound and to realize their limited value in war surgery. The outstanding discovery in wound treatment was the introduction of debridement or wound excision. It is not worth disputing whether this procedure originated in the French, Belgian, or English armies. Its general extension in our service may be associated with the name of Sir Henry Grey.

The splinting of open fractures, especially those of the lower extremities, was greatly advanced by the introduction of the Thomas' and other skeleton splints. It may be noted that it took a war to draw the attention of the general surgeons to the value of the Thomas' splint in the treatment of fracture of the femur. Its use had long been recognized by the Liverpool School, but it was not until its value was urged by the forceful personality of Sir Robert Jones that it came into general use. Ingenious modifications and adaptations of this splint were introduced, many of them associated with the name of Sinclair.

The value of early operation as opposed to conservatism for perforating wounds of the abdomen was fully proved; in 1917 a recovery rate as high as 60 per cent was shown by some units working under favourable conditions on this class of injury.

The active treatment of chest wounds received considerable notice. Advances in the handling of open pneumothorax and empyema were made

which have had no little influence on the development of modern technique in this field.

One may now consider how far advances since 1918 in traumatic surgery have affected our practice. The outstanding changes have been the increased use of plaster of Paris and skeletal traction. In wound treatment Winnett Orr, followed by Trueta, have carried to its logical conclusion the experience of the Great War. How far the use of the complete plaster case for all wounds will prove satisfactory remains to be seen; I have no doubt of its value in certain fractures, e.g. those of the tibia and fibula and of the forearm; provided always that the risks of a rigid casing are kept in mind.

Skeletal traction, which was introduced by Steinman in 1908, gives a degree of control to fragments which we had hitherto lacked. It should not be forgotten, however, that it introduces a potential source of bone infection and also enables such a powerful traction to be applied that the normal process of union may be interfered with. There is no doubt that the use of the method has increased the incidence of delayed union.

Our great hope of improvement in the handling of wound infections is based on the use of the sulphonamide group of drugs. We know their value in established streptococcal infections, but their use as prophylactic agents is as yet experimental. The same may be said of their use in anaerobic infections. The organization which puts at our disposal stored blood is a further factor which should assist in saving many cases of very severe injury.

I will conclude by suggesting that with such a rich experience behind us we stand well armed to carry out our part. What progress we make in wound treatment remains to be seen, but I think we may expect that with due enterprise our work will add something to the sum total of surgical knowledge.

## MEDICAL SOCIETY, DIEPPE AREA.

### CHEMOTHERAPY IN RELATION TO WAR WOUNDS.

BY COLONEL L. COLEBROOK.

THIS subject was discussed at a recent meeting of the Medical Society of the Dieppe Area, the opening paper being given by Colonel L. Colebrook.

He said that the outstanding lesson of the Great War (in the bacteriological field) was the predominant part played by hæmolytic streptococci in wound infections (Fleming and Porteous, 1919; Stokes and Tytler, 1918-19; Medical History of the War, 1923). Although no critical analysis of deaths was made in the light of bacteriological findings it is probable that this one microbe was responsible for not less than 70 per cent of all the deaths due to infections of wounds. The same microbe gave rise to most of the complications such as erysipelas, cellulitis, and septicæmia, which in turn were responsible for incalculable delay in recovery of the wounded and ultimate impairment of function. He recalled that out of 49 positive blood cultures obtained from men with septic compound fractures of the femur no less than 44 were pure cultures of hæmolytic streptococci (Fleming and Porteous, 1919).

Unfortunately we did not learn during the Great War when and why these infections occurred—whether in most cases the organisms were carried into the tissues at the time of wounding, or whether they were transmitted from case to case in the hospitals, or whether they were due in large measure to dissemination of the microbe by dust or by respiratory tract carriers. The only data obtained (Stokes and Tytler) were that about 15 per cent of a series of 365 wounds were already infected by hæmolytic streptococci on admission to the casualty clearing station (average about twelve hours after being wounded), while a very much larger proportion were so infected when examined after a few days at the Base. (Fleming and Porteous give the figure as 90 per cent for one hospital, and there is reason to believe this was not exceptional.)

These figures suggest that hospital infection played a sinister part, and it may well do so again if the number of casualties to be dealt with is at all comparable. Happily we are in a much better position to-day than we were in 1914 to trace the source of these infections. To that end arrangements have already been made for a co-ordinated effort between the R.A.M.C. and the Medical Research Council. Since it would be difficult to carry out adequate differentiation of many strains in France the Council has established a central laboratory in London for that purpose.

We must also learn how to control these infections. That will be no easy task, but there is great hope in the fact that these streptococci (and, incidentally, some of the gas-gangrene bacilli) have proved to be highly



susceptible to the influence of red prontosil, sulphanilamide and its first cousin sulphapyridine (M & B 693). The striking results obtained in erysipelas, puerperal fever, meningitis and pneumonia, together with the unquestionable effects in experimental infections of animals all over the world, give us good reason to believe that these new remedies will prove of great value in controlling the acute invasive phase of established infections by hæmolytic streptococci.

#### PREVENTIVE TREATMENT.

Further, it may well be that by their early administration soon after the man is wounded it may be possible to prevent many of these infections from developing or, failing complete success in that, may render them non-invasive, and therefore much less dangerous to life. The war is likely to give us a far better chance of finding out what is possible in that direction than we should have in many years of peace.

Sir Edward Mellanby recently remarked that if such a preventive effect of these chemotherapeutic agents could be clearly demonstrated it would be almost a more important happening than the war itself.

Colonel Colebrook went on to describe the experiments which justify this hope of successful prophylaxis. Mice had been completely protected (Hoare, 1939) by a single injection of sulphapyridine suspended in oil given within a period of twenty-four hours before they were infected with hæmolytic streptococci. Others had shown very good protection when sulphanilamide was given three hours before infection and at intervals after, whereas, if the first dose was omitted, there was no protection. It seemed quite clear that if a certain small amount of sulphanilamide was present in the circulating blood at the time the streptococci reached the tissues they were prevented from causing an acute infection. That was the essential point to keep in mind in considering how to set about prophylaxis in the wounded. Clearly, if the microbes are implanted in the tissues at the time the man is hit, as is almost certainly the case with the gas-gangrene bacilli, we must start prophylactic treatment at the earliest possible moment, and particularly is this necessary in view of the fulminating course of those infections.

In planning our preventive measures against infections by hæmolytic streptococci, on the other hand, we are up against the difficulty that infection is probably not always caused at the time the man is wounded but may occur in hospital during the next few days. A single prophylactic dose given by mouth shortly after the injury will be almost all excreted within ten to twenty hours, and it seems essential, therefore, if we are to maintain the necessary concentration in the blood during the whole period of danger, that its administration must be continued for at least four days. By the end of that time the injured tissues will presumably be walled off by the processes of repair, and infection, if it does occur, will be a much less serious matter. (Attempts have recently been made by Fuller and James (1940) to find a method of securing slow, continuous absorption from the alimentary

tract in man in order to obviate the need for frequently repeated doses, but so far these have not met with much success.)

#### PROPHYLACTIC DOSAGE.

One could not say dogmatically at present what dosage was required for successful prophylaxis in man as we had no previous experience to draw upon. Rather large doses had been suggested in the first War Office Memorandum (October 11, 1939), but it was explicitly stated that we did not know how they would be tolerated by men suffering from shock and loss of blood. Since that Memorandum was issued new data had come to hand which seem to give us a definite lead as to the dosage required. These data have recently been set out by Fuller and James (1940), together with a suggested plan of dosage designed to give rapid absorption of the drug during the first few hours, and slow, continuous absorption later.

The method advocated was as follows :—

First dose : 1·5 grammes (i.e. 3 tablets of sulphanilamide) dissolved in about 100 c.c. of hot citric acid solution (roughly 1 per cent) or hot lemon.

Second dose : Two hours later, 0·5 gramme (i.e. 1 tablet whole or only partially crushed in order to delay absorption).

Subsequent doses : 0·5 gramme whole or partially crushed, at four-hourly intervals for four days.

Total : 13·5 grammes in four days.

The blood concentrations obtained on these doses in men suffering from shock would have to be checked up to make sure that they corresponded sufficiently well with those obtained on normal men by Drs. Fuller and James. It was important, too, that any toxic effects resulting from these doses should be noted. If they were well borne, but did not suffice to prevent infection, larger doses could be tried later.

In connexion with prophylaxis Colonel Colebrook urged the great importance of trying to reach a definite conclusion. It would be very easy, he said, to reach none at all if the records were incomplete as to the time of starting treatment, the total dosage given each day, the occurrence of gas gangrene, the laboratory findings. He appealed to medical officers in the forward areas and at the Base, as well as to the nursing staff and to laboratory personnel, to co-operate in this investigation. Without that co-operation it could not be carried through.

#### TREATMENT OF ESTABLISHED INFECTIONS.

The dosage required for the treatment of infections already established would not differ very much from that employed in civil practice. There was some evidence that sulphapyridine is likely to be more effective than sulphanilamide for gas gangrene.<sup>1</sup> and, in order to expedite its absorption, the first three doses (1 gramme each) should be given well crushed and as far

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<sup>1</sup> Personal Communication, Dr. D. Stephenson and Miss H. E. Ross.

as possible dissolved in about 100 c.c. of hot citric acid or lemon at an interval of one to three hours. 6 to 8 grammes should be given in the first twenty-four hours and the amount reduced slightly on the next day if the clinical condition was much improved.

For hæmolytic streptococcal infections 1-gramme doses of sulphanilamide should be given four-hourly for the first day or two and the amount reduced *pari passu* with the clinical improvement. For exceptionally severe infections as much as 8 grammes should be given on the first day. The drug should be continued for four or five days after the temperature had dropped to normal and the clinical condition had become satisfactory, but it should *not* be continued after that time just because there were still hæmolytic streptococci in the discharges.

Colonel Colebrook spoke next of the difficulty there was bound to be in appraising the effect of such treatment in wound infections. In the Spanish War different observers had come to very different conclusions because sulphanilamide had been given indiscriminately to all kinds of wound infections—some due to hæmolytic streptococci (presumably) and some not. The same thing had happened when red prontosil was first introduced in Germany and “tried out” in puerperal fever. The obstetric surgeons who used it were not fully alive to the fact that only about 50 per cent of puerperal fever cases are infected by hæmolytic streptococci, the rest being due to a heterogeneous group of organisms, e.g. anaerobic and faecal types of streptococci, *B. coli*, *B. proteus*, staphylococcus, etc. Subsequent experience of puerperal fever has shown clearly that these heterogeneous infections are influenced very little if at all by sulphanilamide or red prontosil. In every 100 cases, therefore, to whom the drug was given by the German obstetricians (without any discrimination as to the kind of infection) there were about 50 who showed no definite response; while among the remaining 50, i.e. the cases infected by hæmolytic streptococci, about 40 will have been cases who were never very ill and whose prompt recovery therefore left a critical observer in some doubt as to the part played by the new remedy. There remained about 10 gravely ill patients who may be regarded as critical material on which to judge of therapeutic effects. The impression made by a few striking recoveries in this small group may easily have been overshadowed by the failure to show any convincing response among the other 90 cases.

If we were to avoid this pitfall in the present war it would seem to be essential that we should from the outset attempt to restrict chemotherapy to wounds known to be infected by hæmolytic streptococci or by gas-gangrene bacilli (and perhaps some severe infections by staphylococcus). He realized that there was a serious difficulty in doing that because we often could not afford to wait twenty-four hours for the result of a bacteriological examination. Often an examination by film alone would suffice, but if it did not he suggested that treatment should be commenced as soon as there were signs of acute infection, and a swab taken from the wound at the same time. The

bacteriologist should be asked to report as early as possible as to the presence or predominance of hæmolytic streptococci and not to bother about other organisms (except the gas-gangrene bacilli) which might take longer to identify. If hæmolytic streptococci were not present treatment could be discontinued. Such a plan might of course be quite impracticable in times of heavy fighting, but Colonel Colebrook thought that, with some increase of laboratory personnel and equipment, it could be carried out at other times.

Although, with experience of many wounds, the surgeons would probably be able to make a shrewd guess as to the presence of streptococcal infection it would be of incalculable value—at any rate for the earlier period of the war—to get data as to the effect of these new drugs on *bacteriologically verified* infections. That should be our aim.

As regards gas gangrene it was all the more important to correlate clinical signs with bacteriological data because there are indications that some of the organisms of this group are not susceptible to these drugs. Colonel Colebrook hoped that all such organisms isolated from clinically refractory cases would be preserved for differentiation and for determination of their susceptibility to the chemotherapeutic agents *in vitro*.

#### AGRANULOCYTOSIS.

It has been stated that this condition occurred only rarely as a result of treatment by sulphanilamide and sulphapyridine, but he could not agree with that view. More than 50 cases of complete agranulocytosis had been reported in the literature during the last two years, and as many more of partial destruction of polymorphs (neutropenia). It was certain that for every case reported there were several—probably not less than 10—that were not reported. He himself had heard of nearly 20.

The particulars of published cases strongly suggest that this dangerous condition (it has a mortality rate of about 50 per cent) is closely related to the amount of drug given and the duration of treatment. The average total dose in the recorded cases had been about 50 grammes, and the duration of treatment twenty days. Occasionally, however, much smaller doses and a shorter period of treatment had been recorded. The condition seemed to occur just as often in association with sulphapyridine as with sulphanilamide.

The use of these drugs on a large scale under war conditions called for special vigilance. Wounded men might be given a prophylactic course at the Front and a second course when they arrived at the Base. Possibly a third in England. Such second and third courses appeared to be particularly dangerous. The risk would be greatly diminished if treatment was given only to cases known to be infected by hæmolytic streptococci (or gas gangrene bacilli), and if treatment was stopped soon after the acute febrile phase had passed. It was the general experience that if an infection did not respond to these drugs within four days it seldom did so later.

Recognition of the beginning of agranulocytosis was often difficult—

indeed the diagnosis could only be made with certainty by a rapidly falling white cell count. The onset was usually insidious—a moderate rise of temperature, increasing prostration, and perhaps some headache. The typical agranulocytic angina was often not present, or developed only as a terminal event.

Colonel Colebrook thought that a white cell count and a rough estimate of the polymorphs should be made on every case receiving large doses of these drugs on the seventh day of treatment and, if a second or third course was given, on the first and third days of such courses. Also at any time if the patient's general condition was unsatisfactory or if a sore throat developed.

In conclusion he urged the need for a sense of proportion in this matter. Agranulocytosis was certainly a real danger. On the other hand, these new remedies were unquestionably of great value. Morphine was also a dangerous drug, but that did not prevent us using it and in sufficient amount, when it was required. We had to learn the definite indications for sulphanilamide and sulphapyridine, and in many cases receiving large amounts to regulate its administration by periodical estimations of the concentration in the blood and by white cell counts. Such safeguards, he recalled, had not proved an insuperable bar to the use of insulin.

#### DISCUSSION.

Colonel Weddell said he hoped that the great importance of the surgical toilet of the wounds—removal of devitalized tissues and renewal of skin edges—would not be overlooked in the attempt to prevent infection by chemotherapeutic agents. He also stressed the need for active co-operation of all medical officers, particularly in the tedious business of "paper work" in the attempt to appraise the value of chemotherapy.

Colonel Stott said he had been surprised at the suggestion that many of the streptococcal infections of the last war had originated in the hospitals and were not directly due to the wound. He hoped this would be fully investigated during the present war.

He was not quite clear as to the distinction between the prophylactic and the curative treatment that was proposed. If an infection by hæmolytic streptococci developed in a man who had received, or was receiving, comparatively small doses for purposes of prophylaxis, should he be put on to full doses?

Colonel Colebrook, replying to the first point, said that since the last war it had been clearly demonstrated (Cruikshank, 1935; White, 1936) that wounds discharging hæmolytic streptococci disseminated that microbe through the air around the patient. Presumably the pus, after drying on the skin, readily flaked off in minute particles of "dust." Such particles retained viable and fully pathogenic streptococci for at least ten weeks. When one remembered the conditions in the crowded surgical wards during times of heavy fighting in the Great War it was difficult to see how the

wounds could have failed to become infected by such dust particles even if infection was never transmitted from case to case in the process of daily dressing.

The work of Sir Almroth Wright in the last war had shown that the hæmolytic streptococcus was better adapted for establishing itself in wounds than any of the other common bacteria because the serous fluids of the wound provide an ideal culture medium for it.

Unless the number of such infections could be kept very much lower by preventive chemotherapy and successful primary suture, it would seem almost inevitable that the surgical wards in the present war would again become hotbeds of streptococcus infection.

Replying to the second point raised by Colonel Stott he admitted that some confusion must arise owing to the fact that the prophylactic treatment had to be continued for several days. If during that period—or subsequent to it—signs of an active invasion by hæmolytic streptococci did develop, he thought the dose of drug should be at once increased to the ordinary scale given for the treatment of established infections.

Colonel Myles asked if there was any evidence as to the efficacy of local applications of sulphonamide derivatives. He had been impressed by one instance in which the spraying of a soluble sulphonamide preparation had been followed by a remarkably prompt disappearance of hæmolytic streptococci and meningococci from the nasopharynx.

Colonel Colebrook, replying, thought it was unlikely that local applications would have any beneficial effect in the upper respiratory tract. Although sulphanilamide had a direct bactericidal action in the presence of body fluids, that effect was usually only manifested after exposure of the organisms to the drug for several hours. It was difficult to imagine that fluid sprayed into the nasopharynx would remain there in effective concentration for more than a few minutes. It was, moreover, improbable that such fluid would find its way into the depths of tonsillar crypts where hæmolytic streptococci were believed to lodge.

The local application of sulphanilamide in suppurating wounds has sometimes been proposed, but it is very doubtful if it would have any beneficial effect (Fleming, 1940). On the other hand the remarkable success claimed by Jensen, Johnsrud and Nelson (1939) in the treatment of compound fractures by a sulphanilamide pack prior to suture (i.e. before suppuration occurs) suggests important possibilities in connexion with war wounds. This is being investigated.

Lieutenant Kanaar asked for more precise information as to "treatment in the febrile phase." He recalled a case of meningitis in which the temperature had come down under treatment but had continued to show irregular fluctuations between normal and 100° F. for ten days or more. The patient had by that time had about 40 grammes of sulphanilamide. Was it wise to continue treatment in such a case?

Colonel Colebrook said that he sometimes saw cases (usually of puerperal

fever) like that cited by Lieutenant Kanaar, and he suspected that they were often infected by an organism which was partially or completely insensitive to the action of sulphanilamide. (In five instances that insensitiveness had been confirmed by an *in vitro* test.) He thought it was not worth while to continue treatment in such cases. And it was doubtful whether anything was gained by switching over to sulphapyridine since streptococci which were insensitive to one were usually insensitive to both drugs. This was, however, an aspect of chemotherapy which needed more investigation. He hoped that if medical officers came across cases in which prophylactic treatment of a wound had been given a good trial and had failed they would send him the organism for examination.

Major Nevin asked what evidence there was as to the relative efficacy of sulphanilamide and sulphapyridine.

Colonel Colebrook said that the results of experimental infections in animals indicated that the two drugs were of about equal value against hæmolytic streptococci, and his own experience of human beings led to the same conclusion.

With regard to infections by gas gangrene bacilli, there was too little evidence at present to permit of any conclusion. In severe staphylococcal infections, too, sulphapyridine seems to be the more effective.

Major Harrison asked what was the present view about cyanosis occurring during treatment by these drugs. Colonel Colebrook said that severe cyanosis was seldom seen nowadays when care was taken to exclude eggs from the diet and to avoid sulphate aperients. The mild degrees of cyanosis could be disregarded and treatment need not be discontinued.

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## SURGICAL REARMAMENT.

BY LIEUTENANT-COLONEL D. C. MONRO, M.B., CH.B., F.R.C.S.ED.,

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THE early weeks of this war must surely have brought back many memories of the last one to all who also served at that time. It certainly did so as far as the writer is concerned.

For many of us it is a case of mobilization with memories this time. Unless one regards this war as merely a continuation of that which started in 1914, it is virtually a case of history repeating itself for those of us who went through the initial months following the order to mobilize then. But this time the excitement which was so evident following the call to arms in 1914, coming as it did after many years of peace and prosperity unbroken except for a minor war here and there, was replaced by a feeling of resignation tinged with sadness at the thought of the futility of war and all its horrors. That it should come upon us again so soon after the lessons we hoped we had learned and the peace we imagined we had established for all time, could not fail to fill us with gloom at the thought of the extent to which private lives must be upset and professional life dislocated. Nevertheless, we have no doubt concerning the justice of our cause or of the direction in which our duty lies.

This time, as far as the Army has been concerned, the initial four months have been free from active participation in actual fighting. The Royal Navy and the Royal Air Force are bearing the brunt in traditional style. In many respects matters have not turned out as was expected, and one hears on all sides the remark "It's a strange war!" To those responsible for the multitudinous tasks associated with the business of putting the nation on a war footing, this period of absence of any serious activity on the part of the land forces is doubtless welcome. Behind the scenes there is no lack of action: the wheels of the vast war machine are turning as it tunes up. The output in terms of national effort is growing daily. So far, the medical services of the State have not been really tried out, and the medical organization for dealing with battle casualties has not, as yet, been tested. Such a state of affairs means temporary inaction and waiting. To men of action inactivity, whether enforced or otherwise, is one of the most difficult things to "stick." Energies seek an outlet. In most cases the search results in the discovery of useful means of expenditure of energy; for instance, there has been a welcome increase in the number of articles submitted to various medical journals on war, medical, or A.R.P. subjects. The correspondence columns in these periodicals indicate increased tendencies to indulge in discussion on controversial matters connected with the same subjects. The perennial battle between the young zealous "Franklin D. Roosevelt Jones" and the experienced and aged "Colonel Blimp" has received fresh impetus. In the case of others, however, there is a tendency for enforced idleness to direct the expenditure of energies which would be used normally on



busy practices or hospital duties, into channels which are not so useful. Occasionally one hears a hint of criticism of those who direct and organize the activities of the profession, and who are very much in the spotlight of public scrutiny at a time like this. It was just the same in 1914. No national emergency will ever be free from whispered scandal or accusations of partiality. Criticism is not necessarily harmful, and strong men who are sure of their ground will disregard it. To be healthy, criticism must be constructive, and based on sure facts. Too often the eddies of complaint, which tend to disturb the smooth waters on which we all desire to see the ship of our united efforts calmly sailing, are produced by those whose principal effort is concentrated on the navigation of their own canoes. In point of fact, and in so far as I am able to judge personally, there are fewer undercurrents of "grousing" than there were in the early months of the Great War. We remember many lessons learnt during that grim struggle, but unforeseen circumstances and unpredictable developments will always be associated with any new major war. Things must be given time to develop; as experience grows matters right themselves automatically. It was the same in 1915. When the departing Commanding Officer of a famous Irish regiment made a last despairing effort to win back to better ways and a sense of discipline the regiment's oldest private and "worst hat," by offering to present him with a special medal if he would reform and henceforth be a better soldier, the Commanding Officer was countered with the stubborn reply, "Ef ut's awl the saeme to yoursilf, Sorr, O'll be arfther kaeping me graevence!" Not until national morality is able to eradicate selfishness, and public conscience and opinion has learnt the way to deal with place-hunters, "wanglers" and their accomplices, can we hope to be rid of that class of individual who would rather sit on the wall to criticize, while harbouring a doubtful grievance, than carry on and do his bit like a man. Would it be entirely wrong to state that the present struggle in which we are engaged is due to the same weaknesses in international affairs? But it was not my intention to drift into an indictment of present-day morals; in fact I am entirely unqualified to express an opinion on the subject. The subject of the medical equipment of the Army, however, is one on which I am better able to speak, because not only have I specialized in surgery during my service in the Army, but the nature of my present official position ensures a constant interest in the *surgical* "armament" in particular. Experience proves that this section of the equipment is prone to criticism. Those of us in the Regular ranks almost expect it. Most surgeons are apt to be rather pernickety on occasion, and it is not a bad trait when a man is keen on his own particular type of tools to the exclusion of other types. Yes, we learn to expect criticism, and always hope that it will be constructive. In a way, it would seem to indicate an apathetic lack of interest on the part of all those who have so recently reinforced our ranks, and whom we are proud to welcome, did we not get occasional criticism and complaint. There are various ways of disarming criticism and dealing with complaints, but in this instance I feel so sure that it is only necessary to make known certain

facts which may not be generally known, and to remove certain misapprehensions, to obtain not only sympathetic appreciation of such difficulties as exist, but also the ready co-operation of all concerned in the efforts of the Director-General of the Army Medical Services in carrying out a heavy programme of surgical rearmament. As the subject may also be of interest to the profession at large, I have had the temerity to offer this article for publication.

During an experience of over twenty years of surgical work in the Army, both in peace and war, I cannot recollect a single instance on which the life of a patient was in jeopardy owing to some particular instrument not being available. By comparison with many civil hospitals, our equipment is adequate without being lavish. It should be appreciated, however, that we are seldom called upon to tackle many of the major forms of internal operation which are common enough in the daily work of civil operating staffs. This remark applies more particularly to stations abroad. A case requiring a lobectomy, for instance, would be invalided to the United Kingdom, where the necessary special equipment is available in the larger military hospitals. For purposes of periodic check and audit, it is necessary to equip the various hospitals on a definite scale, which is usually based on the number of equipped beds. The number of items on this scale is not necessarily rigidly adhered to, but demands for additions must be accompanied by a supporting letter, making out a "good case" for the inclusion of the new or extra items. Under such a system it will be obvious that any alterations in authorized scales will entail much amending of official lists and ledgers. By comparison, the addition of extra items to the armament of a civil hospital is a simple business. It should not be forgotten also that the cost of every item added must be borne by the State. In other words, it is your money and mine. Remember, too, that it is not just a simple question of you or me choosing this or that type of instrument or apparatus because we prefer it; we must choose something which will be generally acceptable to all the others who may have to use it when the issue is authorized and made general. Finally, the choice of certain items may be decided by adaptability for use in the field during war. It will be an advantage to possess a simple pattern which can serve both purposes. Before a new item is added to official schedules then, the question of choice has to be given very careful consideration. In cases where the general utility of any promising item has not been definitely established in the surgical world, specimens of the article are issued to one or two of the larger hospitals for trial and report, and such reports may be submitted to advisory committees before the item is adopted.

It is abundantly evident from indents which have reached the War Office recently, that the advantage, if not the necessity, for sticking to approved types and patterns is not appreciated. While the situation at present warrants a degree of laxity and elasticity in respect of such demands, which could not be permitted in peace, a state of war is not necessarily sufficient excuse for an orgy of reckless extravagance. More latitude is permissible

because situations arise in war which are inseparable from it, but it is all the more essential for someone to check extravagance and curb eccentricity. I was asked to express an opinion on an indent submitted recently. The first four items were merely variants of authorized patterns ; a kink here, an extra tooth, and a designer's or modifier's name attached ; but that was the sum total of the difference. The inclusion of such items could only have been due to ignorance of authorized patterns, personal preference, or prejudice. Allowances can always be made for preference regarding instruments with an "individual" character, such as needle holders, for instance, but Army equipment should be supplied with a pattern which is generally acceptable. If a surgeon cannot get along with the accepted pattern he has no choice but to purchase the type he prefers from his own private funds. In the Army, surgeons change stations about once every three years, but it would be ridiculous to attempt to equip each theatre separately to suit individuals. The next item on the indent mentioned above was a costly, modern, all-purpose anæsthetic apparatus. I have seen this apparatus, and I am not attempting to decry it. But, on referring to records, it was ascertained that the hospital from which the new indent emanated, was already in possession of a standard make of nitrous oxide-oxygen-ether apparatus, which has been functioning quite satisfactorily till the regular staff mobilized. Nevertheless, the matter was considered, and to make sure that such an addition was not really necessary, especially at a time like this, a specialist of the highest reputation was consulted. His remark was, "Good heavens, that apparatus isn't necessary. That chap should be told there's a war on!" Another officer without technical knowledge, who chanced to come in as we were discussing the illustration, facetiously remarked, "What's that ? Looks like some sort of combination of magnetic mine and cocktail cabinet !" We are inclined to think that our colleague who submitted this indent was quite ignorant of regulations dealing with equipment, and merely thought it would be fun to have the latest apparatus to play with. The country was spending millions, so what difference would the odd £50 make ? There is no doubt, however, that when an indent is turned down officially the action may give rise to resentment. Such a reaction by the originator, coupled with annoyance in the department responsible for indents, results in a tendency for both parties concerned to regard the incident as "unfortunate." A wrong indent is, therefore, doubly unfortunate, and it is hoped that some of the considerations I have endeavoured to place before my readers may prevent them being submitted.

To return to official scales. Once adopted, an item is "sealed." Full particulars are registered and a specimen, bearing a label which is sealed on, is deposited in the Army Medical Stores. Manufacturers are obliged to reproduce the item to the sealed specifications and at a price fixed by contract. To assist in keeping records, items are classified and listed by sections. For instance Section 1 contains the drugs, Section 2 compressed tablets, Section 3 dressings, Section 6 instruments, etc. When received at Army

medical store depots the items are checked and taken on charge by the subordinate in charge of each section. These civilian employees have no qualified technical knowledge (except dispensing) but are experienced packers, and their memory for the items in their section is remarkable.

It is customary, as well as useful, to divide items in general into two classes : (a) Consumables, and (b) non-consumables. These terms are self-explanatory. During peace, stocks of consumables are kept as low as possible, in order to ensure adequate "turnover." The other class may be stored in considerable numbers, because certain items in general use are bought in bulk, and at rates which are consequently cheaper. All the items are subject to periodic review ; items may be changed for newer patterns or types, or additions made.

So much for arrangements for normal peace work. There remains the very important question of mobilization equipment. The equipment for the medical units which will accompany the field forces must be kept packed, stored, and ready to the last tablet or safety pin, for instant despatch. It is an accepted principle that this "mob" equipment must on no account be broken into without authority from the higher command. As this mass of equipment which goes to make up these units has to remain in Army medical stores, it must be regarded in the nature of "frozen assets." The consumable items are continually "turned over" and the non-consumable subject to periodic inspection.

At the end of the Great War there was a vast amount of surplus equipment of all sorts which had to be disposed of. Army disposals boards got rid of tons of it, mostly by auction. The market for surgical instruments became flooded with cheap serviceable articles. Most surgical instrument makers were badly hit. It must be assumed that this result was not foreseen, or that wider issues forced those responsible to disregard it. Surgical treatment in the field in 1918 had become almost standardized and so had the equipment. Quite naturally, then, much of this proved equipment was stored with an eye to building up new mobilization units, though few thought that such units would be required. The average man imagined that the days of war were ended, and that mobilization was a dead word. 1931 found us verging on national insolvency, and the order of the day was economy. Numerous "cuts" followed. Mobilization equipment was again reviewed. There appeared to be no satisfactory reason for amending it. Because some of the items were hardly the last word in modernity, that was no reason for discarding them. They were proved and still serviceable. Since then events crowded upon us with such rapidity that it was soon apparent that we should only be saved from involvement in another major war by a miracle. It was imperative to rearm. Everything indicated that the full resources of the nation would be taxed. The Government wisely began to mobilize industry. Consultations were frequent ; work programmes were outlined. The Association of Surgical Instrument Makers played up splendidly in organizing production to meet the enormous new demands of the defence services—both civil and military.

Many instruments are made by skilled forgers who specialize in one or two items only. These skilled technicians are not found on every bush. The staffs, too, in many of the shops or works were soon being depleted by enlistments into Services. In order to help firms out with their programmes, machine-made "stampings" of some of the commoner instruments had to be accepted, although some of the older-established firms with reputations for skilled craftsmanship to think of would not condescend to adopt such mass production methods. Where there happened to be two types of a particular item, both equally efficient, the War Office was occasionally asked to accept the simpler forging.

The trend of surgical technique during the last year or so did not appear to indicate the necessity for any very radical changes in surgical mobilization equipment. Our observers had been keeping in touch with the fighting in the Far East and in Spain, but no epoch-making discoveries had been reported. Böhler and Watson Jones, and others in this country, had advocated plaster technique in fracture treatment, again stressing the advantages of this form of splinting. Trueta's accounts of wholesale adoption of the Winnett Orr closed plaster methods in Spain demanded attention. There were indications that plaster-and-pin traction methods in war surgery had come to stay. For the first-aid treatment of injuries of the leg the Thomas' splint retained its position unassailed. Successes with the sulphonamide group of drugs continued to be reported, and hopes have been raised that the dread complications following implantation of infection in tissues devitalized by missiles may be greatly reduced, if not totally eliminated. The blood transfusion service in Spain had been carefully studied, and the detail of the Army Blood Transfusion Service in this country had been worked out early in the spring. We had already learned the undoubted advantages of segregating special types of injuries, notably fractures.

When war was declared, the medical units which had been built up in peace proceeded overseas with the B.E.F., and the assembly of new units required for the rapidly expanding forces in the field was immediately put in hand; the equipment for the new units is based on the "mob" scales. Experience, as it accumulates, may and doubtless will, indicate minor amendments to the scale.

In general, the "mob" equipment of to-day differs from the old scale in the following respects:—

*Surgical Instruments.*—While the basis of each surgeon's equipment is an efficient "excision" set, which each "team" surgeon will carry with him when reinforcing a surgical unit, sets of special instruments for abdominal, chest, and head wounds, are issued on the scale of one set of each per operating room. Suture needles have been modified and now consist of a "surgeon's assorted set" for operating rooms and a "first-aid set" for surgical and regimental panniers. The old set of trephines will be replaced by brace, perforator, and burr, in situations where packing space permits. It has also been decided to reduce the set of E.N. and T. instruments issued for a

specialist, and the efficiency of the set will be maintained by inclusion of some modern items. Where there is no specialist "emergency E.N. and T. and tracheotomy sets" will be available in each theatre for use by general surgeons.

*Anæsthetic Apparatus.*—Field Boyle-Magill (nitrous oxide-oxygen-ether) apparatus with Magill endotracheal tubes and connexions are issued to all operating rooms.

*Blood and Saline Transfusion Apparatus.*—The old Robertson bottle is being removed and a choice of the following is available :—

Army Blood Transfusion Service : It is intended to make the needles and metal tube adaptors of this apparatus standard for the remainder.

Mariot and Kekwick set.

Field service set (panniers).

Three-way syringe and stop-cock to fit record syringes which will be issued in future with eccentric nozzles.

All drip indicators to have side arm and clip for regulation.

*Splints and Fracture Apparatus.*—Apart from the Thomas' arm and leg (knee) splints, the majority of the named splints, many of which are bulky, have been removed as obsolete, and their places are taken by plaster bandages and slabs or malleable wire (Cramer) or expanded metal splinting.

Extension. First-aid units : A spring boot-clip will replace the old skewer. C. C. S. Sinclair glue or "extension" elastoplast (widths for arm and leg). This item is expensive, and should be used only for the purpose for which it is intended. Broad tape continuations should be incorporated when using it. At the base : Böhler stirrup and pins, Kirschner stirrup and wire, used in conjunction with Braun, Böhler, or Thomas' splints. Plaster in suitable cases. For the new units only even number sizes of rings for Thomas' splint, sizes 22 to 28, will be issued. For use in war, the main objection to the Thomas' leg splint is the space it occupies in storage and transport. Modifications received from time to time might suggest that the splint has serious defects, but apart from facts that such modifications as split, detachable, or half rings, all have disadvantages for use in the field ; they also add very considerably to the cost of production. The consensus of opinion is against such modifications.

In conclusion, constant touch is being kept with surgeons now with the B.E.F. through the Consulting Surgeon, and while it should be the aim of all Army surgeons to develop a technique which is based on the use of simple tools and apparatus and to make use of the surgeon's most useful ally—improvisation—it is surely not necessary to add that all modifications in the equipment which further experience appears to indicate as essential to the maintenance of the primary function of our Service, namely, the adequate treatment of the wounded soldier, will receive ready and sympathetic consideration ; if approved, new items will be supplied as soon as the trade is able to meet the demand.

## EXTRACTS FROM THE MEMORANDUM ON CEREBROSPINAL FEVER AMONG TROOPS.

We have received these extracts from the Memorandum and the Addendum on cerebro-spinal fever from the Director of Pathology, A.M.D.7, War Office.

### ADMINISTRATIVE MEASURES TO BE ADOPTED WHEN THE DISEASE OCCURS AMONGST TROOPS.

#### *Action to be Taken by the Officer in Medical Charge of Troops.*

THE medical officer to whose notice the suspected case first comes will :—

I. Telephone or telegraph at once, giving the patient's name, rank, Army number, age, unit, station, and address, to :—

(a) The pathologist in charge of the laboratory allotted to the area in which the suspected case is stationed (includes Laboratory of Emergency Public Health Service).

(b) A.D. or D.A.D. Pathology of the command or district.

II. Notify on Army Form A.35<sup>1</sup> as soon as possible, the following :—

(a) A.D.M.S. District.

(b) D.D.M.S. Command.

(c) The Under Secretary of State for War (A.M.D.5), War Office, London, S.W.1.

(d) Local Civil Health Authorities.

III. Make arrangements for the isolation and treatment of the case, and for the isolation of contacts pending the arrival of the pathologist.

*Contacts.*—The term contacts of a patient sleeping in barracks, schools, or halls, will be interpreted as those men occupying beds adjoining the case ; in the event of a case arising in a billet or tent all occupants will be regarded as contacts.

Swabbing and segregation of those who may have been otherwise in association with the patient will not be undertaken.

Wholesale swabbing of large numbers of persons serves no useful purpose owing to the high incidence of carriers of the meningococcus amongst the healthy population during the winter months. It is manifestly impossible to isolate a large percentage of the population.

### GENERAL PREVENTIVE MEASURES (*vide* Regs. A.M.S. 1938, Appendix 2).

Overcrowding must be avoided.

In sleeping quarters there should be an interval of at least 6 feet between the centres of adjoining beds. In war-time, however, owing to the circumstances, this interval may require to be reduced, but it is absolutely essential to ensure that a minimum distance of  $2\frac{1}{2}$  feet is maintained between the beds. If the distance between the beds is less than  $3\frac{1}{2}$  feet, every alternate

<sup>1</sup> Army Form A.35 should be completed in all details, in particular it should be fully stated whether the case has occurred in barracks, huts, hired buildings, billets, tents, etc.

bed should be turned round so that each man sleeps with his head opposite his neighbour's feet. Extra space can also be obtained by pulling some of the beds into the middle of the room.

*Disinfection of Nasopharynx.*

Mass gargling and insufflation on parade, with one part of permanganate of potash in 5,000 parts of 0·8 per cent saline solution is of doubtful value, and is not recommended as a routine procedure.

*Treatment.*—Drugs of the sulphonamide series have now an established place in the treatment of meningococcal infections. Their employment has not only reduced the mortality, but also changed the general aspect of the disease. There are two derivatives whose value in cerebrospinal fever has been substantiated. They are : (1) Sulphanilamide (synonyms : sulphonamide P, colsulanyde, streptocide, prontosil album) ; and (2) M & B 693 (synonyms : sulphapyridene, dagenan). Other compounds should not be used. While it is the rule to administer only one of these agents during the course of the disease, occasionally it will be found that the drug selected is badly tolerated. The onset of symptoms such as nausea, vomiting, depression, or insomnia will indicate intolerance. These symptoms usually disappear if a change from one compound to the other is made. It is inadvisable to make too frequent a change from one drug to the other, and it is important that the administration of these drugs should not be suspended on account of these symptoms except only in extreme cases. Some clinicians have used these chemotherapeutic agents in combination. Successful results will only be achieved if the dosage administered is sufficient to maintain in the cerebrospinal fluid a concentration of 5 mg. per cent for three days and a slightly lower concentration for a further period of five or six days. In the majority of cases treated in this way, the acute symptoms subside in two to six days, the temperature falls to normal, and the rigidity passes off. In some cases the results are dramatic, marked amelioration of the condition being evident within twenty-four hours ; this is more noticeable in those cases which on admission to hospital are delirious or comatose. Since the introduction of these drugs the nursing of meningococcal meningitis cases, which formerly was so troublesome, is now a comparatively easy task after the first twelve hours of infection. So long as these compounds are being administered the intake of fluids should be approximately four pints a day for adults, in order to maintain a reasonable balance between blood concentration and urinary excretion. The most satisfactory laxative is liquid paraffin, or the bowel may be emptied by an enema. Saline purges and drastic purgatives should be avoided. Lumbar punctures are required only as a guide to treatment. Relief of pressure and drainage of fluid as a therapeutic measure is only required after the first puncture, if symptoms demand it. When repeated puncture appears to be necessary, opportunity should be taken to check the concentration of the drug in the specimen.

Administration either by the mouth or by intramuscular injection



results in those drugs rapidly reaching the spinal fluid of normal subjects and those with inflamed meninges. Both sulphanilamide and M & B 693 should be administered by the oral route. If, however, the patient is vomiting or has difficulty in swallowing, a four-hourly intramuscular injection of 3 c.c. (= 1 gramme) M & B 693 soluble (synonym : Dagenan sodium) should be given, but a change back to oral administration should be made at the first opportunity. The total dosage during twenty-four hours should be 8 grammes and in extreme cases up to a maximum of 10 grammes. The spacing of the dosage is important. The compound should be given four-hourly night and day. At the commencement of treatment half the total twenty-four hour dose should be given during the first two administrations. After these initial administrations, the twenty-four hour dose should be divided so that an equal amount of the drug is administered every four hours. This procedure should be continued for two and a half to three days and then the dose gradually reduced over the next six days to 2 or 3 grammes *per diem*. It is important that the administration should not be interrupted. To prevent recurrence of infection the sulphonamide drugs should be administered for some days after the disappearance of clinical symptoms, but normally the total period of administration need not exceed nine days. The combined use of anti-serum and chemotherapeutic agents does not appear to influence the course of the disease. If serum is used it should be given intravenously or intramuscularly and not into the theca. Groups I and II meningococci are equally susceptible to these chemotherapeutic agents.

#### ADDENDUM TO THE MEMORANDUM ON CEREBROSPINAL FEVER AMONGST TROOPS DATED 23.1.40.

##### INITIAL ADMINISTRATION OF M & B 693 IN CASES OF DELAYED DIAGNOSIS AND TREATMENT, AND IN FULMINATING CASES.

Cases of meningococcal meningitis, on occasions, have an onset so insidious that their nature may not be recognized until late in the course of the disease. In these circumstances it is essential to lose no time in ensuring the absorption of the drug. Whenever there is a suspicion that there has been any delay in recognizing the condition, whether the patient is conscious or unconscious, *the first dose* should be an intramuscular injection of M & B 693 soluble (Dagenan sodium). As soon as meningeal involvement is suspected the injection must be given. It must not be delayed until the case is admitted to hospital or lumbar puncture performed.

The suggested scheme for the administration of the drug is as follows :—

##### *Cases Whether Conscious or Unconscious.*

*First Dose.*—1 gramme (= 3 c.c.) M & B 693 soluble by intramuscular injection.

*Subsequent Doses.*—*If unconscious :* Repeat intramuscular injection of M & B 693 soluble, 1 gramme, four-hourly.

*If conscious and able to swallow:* Administer 1 gramme of M & B 693 in tablet form, or crushed and dissolved in 100 c.c. of hot citric acid solution (roughly 1 per cent) or hot lemon, by the mouth two hours after the intramuscular injection and then 2 grammes by the mouth four hours later. (This represents approximately half the total twenty-four hour dose.) Thereafter proceed as indicated in the memorandum.

### *Fulminating Cases.*

The onset occasionally is extremely rapid. It is essential that there should be rapid mobilization of the drug to all the tissues. The suggested scheme for the administration of the drug in such cases is as follows:—

*First Dose.*—This should consist of two injections given simultaneously: (1) *Intravenous injection:* 1 gramme (= 3 c.c.) M & B 693 soluble, diluted in three or more volumes of saline. (2) *Intramuscular injection:* 1 gramme (= 3 c.c.) M & B 693 soluble.

*Second Dose.*—Intramuscular injection of 1 gramme (= 3 c.c.) M & B 693 soluble four hours later.

*Subsequent Doses.*—These must be judged by the condition of the patient. Dosage may be continued according to the scheme given above for cases of delayed diagnosis and treatment.

*Administration of Fluids.*—Three or four pints daily should be given by such method as is practicable, either oral, rectal, subcutaneous, or intravenous.

### *Notes on Intramuscular Injections.*

M & B 693 soluble is very alkaline in its reaction. It may cause necrosis in subcutaneous tissue and care must be taken to ensure that the injection is made deep into the muscle.

Pain is often experienced during the injection of the drug, which must be given slowly. In addition, patients suffering from cerebrospinal fever are frequently restless and irritable.

The following technique is, therefore, suggested for its administration: Fill a 1-c.c. Record syringe with 1 per cent novocain. Attach to it a No. 2 serum needle. Raise an intradermal wheal with novocain, drive needle through this, injecting as it goes until full depth is reached, whereupon inject 0.5 c.c. novocain. Detach syringe from needle. Attach 5 c.c. syringe filled with the dose of M & B 693 and inject drug slowly. Detach 5-c.c. syringe. Reattach 1-c.c. syringe containing 0.5 c.c. novocain. Inject 0.25 c.c. novocain to clear the needle. Withdraw needle, injecting novocain to fill needle track and prevent escape of M & B 693.

*It is most important that a documentary record of the nature, dose, and method of administration of the drug that has been given should accompany the patient to hospital.*

## Editorial.

### TRENCH FEVER.

TRENCH fever is an infectious disease characterized by febrile periods which tend to occur at regular intervals, by local pains, by an erythematous rash, and by enlargement of the spleen.

It was noticed by Graham in the British troops in Flanders in the summer of 1915, in Salonika by Hurst in the latter part of the same year, in French troops in France in 1916, and about the same time in Italy. It also occurred in the German and Austrian armies.

Graham published the first description and noticed in two cases the characteristic tendency to relapse. Hunt and Rankin shortly afterwards gave a more complete clinical account and in their paper the name "Trench Fever" first appeared. The name first came into use among soldiers and was adopted directly from them. McNee, Renshaw and Brunt began their study of the essential pathology of the disease in the early summer of 1915, and successfully accomplished the transmission of the disease from man to man in September, 1915.

At first the disease only occurred in the front areas and was hardly noticed at the base. Hospital officers, nurses, and orderlies caught it, and later when officers and men were sent to Army schools, they brought the disease into the base areas.

It is impossible to give with any accuracy the rate of incidence among the troops. The name trench fever was not sanctioned until 1917 and was not made notifiable until 1918. It is almost certain that many of the cases diagnosed as pyrexia of uncertain origin, myalgia, and rheumatism were really trench fever. Accurate observations were made in four base hospitals in Boulogne by Lewis, Thursfield, Tex Blake and Foster, who found that 62 per cent of the cases diagnosed as these diseases were trench fever.

It was calculated that an army of 1,000,000 men would lose in a year by evacuation to the base at least 45,000 casualties from trench fever. Of these cases 80 per cent would lose sixty days in hospitals or depots and at least three months in all off duty. Some 2,000 cases would be incapacitated for a period of six months. There were no deaths, but the loss of man-power resulting from the new disease was a heavy drain on the Army.

In all the early cases of the disease, seen before July, 1915, the fever was a short one, lasting as a rule five to seven days, and followed in the majority of cases, but not in all, by a single short relapse. Once the relapse was over the patient felt well and returned to duty almost at once. The invaliding for trench fever at this period was therefore nil.

In July, 1915, was seen the first of what was described by McNee, Renshaw and Brunt as the long or relapsing type of fever, where the initial period of pyrexia was shorter and the relapses more frequent and severe. The first case observed by Sir Wilmot Herringham and McNee was very

puzzling at the time, and was thought to have no relation to the short type of febrile disease. Up to December, 1915, about 20 similar cases had been seen. It was eventually concluded, following on the experimental transmission from man to man by the blood, that both the long and the short types of fever were one and the same disease. Later it was found that intermediate types also existed. In the summer of 1916 Hunt and McNee were astonished to find only the long type of fever at casualty clearing stations. It appeared that as medical officers became familiar with the disease in epidemic proportions, the short types of fever were retained with the units and treated there. From a wide experience of the disease McNee concluded that as the epidemic developed the severity of the disease and its virulence gradually increased, so that in the later periods of the war the disease was much more serious for the individual than at the beginning. During the early part of the war none of the exhaustive sequelæ such as neurasthenia and tachycardia was ever observed, but towards the end they became a source of great trouble. The chronicity of the disease was attributed to increased virulence and to exhaustion of the troops through a long campaign.

Investigations on trench fever were at first carried out by individuals on account of the scientific interest, and it was not until 1917 that a Trench Fever Committee was appointed by the Director-General of the Medical Services in France. Soon afterwards the American Red Cross Society was instrumental in forming an American Commission to investigate the disease, and by arrangement the British and American work was concentrated in the same hospital at St. Pol. About the same time the War Office appointed a commission to investigate the cases invalided to England: fortunately the patients had been collected at the Mount Vernon Hospital, Hampstead. The resources of the Lister Institute of Preventive Medicine were also available for special parts of the work.

At first cases of trench fever were suspected to belong to the enteric group of fevers; but agglutination tests, blood cultures in bile-salt broth, plating of fæces and urine, proved fruitless. Later, after the triple vaccine against enteric fever had been introduced, Dreyer's agglutination methods were adopted, but again no evidence supporting a typhoid basis for the disease could be discovered. Workers with the American Red Cross Commission reinvestigated the disease on general bacteriological lines.

From the beginning much attention was paid to the examination of blood-films for the presence of a parasite, or for alterations of the blood-counts and changes in the morphological appearances of the blood-cells, which might be of diagnostic value.

The great majority of workers failed to detect a parasite of any kind using wet and dry films, diverse methods of staining and fixation, and dark-ground illumination.

The earliest description of the blood picture in trench fever was given by Rankin and Hunt, who noted the average leucocyte count in twenty-four hours to be 10,500 with variations ranging between 4,700 and 22,000.

No mention was made of morphological changes in the red blood corpuscles.

McNee, Renshaw and Brunt found leucocyte counts varying from 5,200 to 18,200. In the red cells they observed the presence of polychromatophile cells above the normal in size and, especially in relapsing cases, well marked punctate basophilia, which in some cases suggested an intra-corpuscular parasite.

The explanation of these changes was found when all the men showed a definite defect in the amount of hæmoglobin, the average colour index being 0.8. The presence of punctate basophilia was accidental and not an essential feature of the disease.

Later in the war the hæmatology of trench fever was fully investigated by Perkins and Urwick, who concluded that there is no appearance in blood-films which is characteristic of the disease. A composite picture frequently found consists in a marked rise of leucocytes of all three kinds at the time of the febrile relapse, and a gradual relative rise in the lymphocytes during the period of convalescence. Perkins and Urwick noticed in the red corpuscles, and especially during a relapse, characteristics occurring in great numbers in the so-called *corps in demi lune* which had been described previously in connexion with trench fever by Renaux. McNee noticed the same phenomenon in blood-films from many cases. Perkins and Urwick, however, point out that the bodies are in no way specific. They are frequently found in malaria paroxysms and in conditions associated with high pyrexia.

In several cases of trench fever the onset of the fever so closely resembled cerebrospinal fever that lumbar puncture was performed. No excess of cells existed and no abnormal constituent was present.

The results of bacteriological examinations of the urine were negative. In no case did signs of nephritis develop during the fever.

Fortunately the disease was never fatal, so there are no recorded post-mortem findings in a recent or old infection. When the disease was very prevalent McNee examined histologically the spleens of wounded men where they were enlarged, but no parasites were found nor anything suggestive of a parasite ever detected.

In the summer of 1915 McNee and his colleagues, recognizing that they were dealing with a new disease, began animal experiments, employing rabbits, white mice, and rats, and later guinea-pigs. None of the experimental animals developed pyrexia or showed any sign of successful inoculation. Similar animal inoculations were repeated by members of the American commission; these results were also negative. Animal experiments having proved a failure, McNee, Renshaw and Brunt attempted to transfer the disease to man. Pooled serum from acute cases in field ambulances was used in the first experiments, but without result. Finally it became possible to carry out inoculation with whole blood taken from the vein of a patient directly into a syringe, which had been washed out with a solution of sodium citrate, and injected forthwith into the vein of a volunteer.

The experiment was completely successful, the volunteer passing through a severe and typical attack of fever.

Seven experiments were performed with whole blood and all were successful, whether the intravenous or subcutaneous method of inoculation was employed. The incubation period varied from six to twenty-two days, and the blood was shown to be still infective on the twenty-second day when pyrexia was absent. The infectivity of whole blood was confirmed by the American Commission who in a series of sixteen cases had only one unsuccessful result.

The British Commission also established the constant infectivity of whole blood in a series of six experiments and were able to show that the blood of a patient was still infective three hundred days after the onset of his fever.

McNee, Renshaw, and Brunt then endeavoured to find out what part of the blood contained the virus. As a result of their experiments they arrived at the following conclusions: (1) The disease is transmissible in every case by whole blood; (2) it is not transmissible by the serum; in some cases in which serum proved infective hæmolysis of corpuscles had occurred before injection; (3) the virus in the serum is not a filter-passer; (4) the virus appeared to be contained in the white or red corpuscles: blood corpuscles, after washing five times in saline to remove the plasma, are still found to be infective, which supports the view that the virus is intracorpuseular; (5) blood corpuscles when broken down and the hæmoglobin-tinted fluid passed through a filter and injected are found to be non-effective: this seems to show that the virus in the corpuscles is not ultra-microscopic.

These experiments, made in 1915, remained unconfirmed until the American Commission took up the same problem in 1918. In these experiments the plasma injected in amounts ranging between 6 to 13 c.c. was found to be infective. The Commission believed the virus exists free in the plasma and is not intracorpuseular. They were unable to establish the filtrability of the virus from any of the constituents of the blood.

The Americans found the virus was present in the urine, but not in the fæces. They also found that where bronchitis was present the virus might pass into the sputum, but as a source of infection in ordinary epidemic circumstances it must be of minor importance.

The method of transmission of the disease remained unknown until 1916, when Hunt and McNee brought forward evidence in favour of the transmission of the disease by the body-louse. Hurst, working in Salonika, brought forward equally suggestive evidence in favour of louse transmission.

Nearly two years elapsed before the systematic experiments of the American Commission in France and the British Commission in London showed conclusively that the body-louse transmitted the disease in Nature.

The main results of the experiments of the British Commission are incorporated in a book by Lieutenant-Colonel Byam, who was one of the members. Byam gives the conclusions with regard to the infectivity of trench fever and its method of transmission as follows:—

“We are of opinion therefore that trench fever is conveyed by the

excreta of infected lice ; that the excreta may enter through the broken skin or unbroken conjunctiva ; that rubbing and scratching promote infection, but that the bites of lice may possibly cause a sufficient lesion to enable the virus to enter the body."

The findings of the American Commission were incorporated in the following way in their report :—

" That the disease is transmitted naturally by the louse *Pediculus humanus*, Linn. var. *corporis*, and that this is the important and common means of transmission. That the louse may transmit the disease by the bite alone, the usual manner of infection, or the disease may be produced artificially by scarifying the skin and rubbing in a small amount of the infected louse excrement."

While there is complete agreement on the fundamental point of louse transmission there was a difference of opinion as to the way in which the louse plays its part. The Americans believed that the virus is transmitted to the new host by the bite of the louse and that this is the common means of infection. The British Commission were of opinion that the usual method of natural infection is by the excreta of infected lice entering through an abrasion in the skin. They believed that the puncture of a bite may possibly be sufficient to allow the entry of the infected excreta, but did not think this could often occur.

In the American experiments a strain of lice used was a laboratory strain which had been kept going by Bacot for over two years. This was known as the clean stock. Other experiments were carried out for definite purposes with lice hatched out from verminous clothing in France. In other experiments performed lice were taken from the clothes of soldiers admitted as cases of trench fever. Of twenty-six transmission experiments fourteen were successful. Eleven successful results were obtained when using Bacot's clean strain of lice, and two with lice taken from trench-fever patients.

Lice were allowed to feed naturally on the fore-arm of experimental subjects. In the first set of experiments, sixteen in all, no attempt was made to prevent the deposit of lice faeces on the skin. The lice were placed in a box fixed to the arm of the subject by strapping or bandage, and the experiments proved conclusively that lice had to do with the transmission of infection, but gave no clue as to the relative importance of infection by bites or by deposit of faeces on scratches or on abrasions of the skin.

In another set of experiments the box was fastened to the under surface of the fore-arm so that the boxes hung down and the lice had to bite through a larger cambric covering the box and placed next to the skin. The surface of the bitten area was carefully cleansed after each feeding so as to remove any small specks of excrement seen with a hand-lens. Two men exposed to infection in this manner both became infected, one after twenty-seven days and the other after thirty-eight days. No scratching or abrading of the skin was possible in these cases.

The British Commission collected the excreta of 600 lice which had fed for twenty-seven days on many cases of trench fever. A small area of skin

on the upper arm of a volunteer was scarified lightly so that blood was just drawn and then a portion of the dry powdered excrement was rubbed into the blood and made into a paste with it. Eight days later the man developed trench fever. This experiment was the starting point of all the subsequent work of the Commission, Bacot's clean lice being used for all critical experiments. In addition to transmitting the disease by scarification and rubbing in infected excreta, success was obtained in a subsequent experiment by squashing eleven lice over a scarified area of skin. It was shown that real trench fever was produced in this way by carrying on the infections to new volunteers by injecting whole blood. Control experiments, in which the faeces of normal lice from Bacot's strain were rubbed into scarified areas, were always unsuccessful and experiments showed that infected lice excreta remained potent for a long period. In three experiments the dried excreta had been kept for sixteen, sixty, and a hundred and twenty days, a fundamental point in connexion with the prophylaxis of the disease. The Commission also showed that infected lice did not transmit the disease by the ova to their offspring. They also proved that lice did not become infective until five days after they had fed on a trench-fever patient. Lice, once infected, continued in this state until their death, and a very high proportion of lice become infected after feeding on a trench-fever patient.

In two experiments the Commission was able to prove that the excrement from a single infected louse, collected for a period of five days and then inoculated in the usual way, brought about typical attacks of the fever after eight and nine days' incubation.

It is evident from the experiments detailed that the virus of trench fever is constantly circulating in the peripheral blood during the disease. No means have been discovered of demonstrating the causal organism to the eye, and the conclusion has been drawn that it is ultra-microscopic. The conclusion that the virus at one stage of its existence is a filter-passer rests on some experiments of the American Commission on filtered urinary sediment and on filtrates of infected lice excreta. The British Commission were unable to confirm these results as all their filtration experiments with emulsions of infected lice excreta were negative, except in two cases where the filter also allowed the passage of *B. prodigiosus*.

In 1916 it was shown by Töpfer and confirmed by Jungmann and Kuczynski and Munk and Roca-lima that lice which had fed on trench-fever patients contained very large quantities of Rickettsia bodies, *R. quintana*, in the mid-gut. Roca-lima found that they were lying on the surface of the epithelium and were not in an intracellular position like *R. prowazeki* in typhus-infected lice.

After the Great War Arkwright, Bacot and Duncan worked on the relationship of Rickettsia to trench fever, and in 1919 gave an account of their work. They found in the faeces of infected lice abundant bodies apparently identical with the Rickettsia described by other workers. In deciding on the presence of Rickettsia they adopted the following characters :



Minute size smaller than *M. melitensis*, usually about  $0.3\ \mu$  by  $0.3\ \mu$  or  $0.3\ \mu$  by  $0.5\ \mu$ ; irregularity in shape; does not form threads or chains; occurrence in very large numbers; when stained with Giemsa for some hours the colour is purplish but not so red a tint as *R. prowazeki*. The lice used in these experiments were Bacot's strain which had been maintained for over three years in the laboratory. Arkwright and his co-workers showed that these lice when fed on seven healthy men never developed any Rickettsia. On the other hand, feeding on trench-fever patients both in the febrile and apyretic stages led to the development of Rickettsia after an incubation period of four to twelve days.

A very similar form—*R. pediculi*—found in lice from apparently normal people—was considered to be in reality *R. quintana* in most cases, and was probably derived from hosts in which the infection existed but had not been detected.

Carefully controlled experiments showed that there was a constant association of the virus of trench fever and the presence of *R. quintana* in lice excreta. Arkwright and his co-workers believed the matter to be finally settled. In 1920 Ledingham published experiments showing that the injection of Rickettsia into laboratory animals gave rise to agglutinins, which is in favour of a bacterial origin of the bodies.

A point of importance in the prevention of trench fever is the resistance of the virus to heat and chemicals. Practically the problem is to disinfect blankets and clothing, etc., so as to destroy the virus.

The American Commission found that the virus in louse excreta is fully virulent after exposure to  $60^{\circ}\text{C}$ . moist heat for thirty minutes but is destroyed by a temperature of  $70^{\circ}\text{C}$ . under the same conditions. They concluded that a temperature of  $55^{\circ}\text{C}$ . which destroys lice and their ova is insufficient to disinfect infected clothing and blankets. The British Commission found that moist heat at  $60^{\circ}\text{C}$ . for twenty minutes destroyed the virus. The virus resisted dry heat at  $80^{\circ}\text{C}$ . for twenty minutes, but succumbed to a temperature of  $100^{\circ}\text{C}$ . Lysol, 2 per cent, was also found to destroy the virus in twenty minutes. Washing of blankets and underclothing in hot soapy water for twenty minutes had no effect.

Natural immunity to trench fever is considered very rare. The British Commission thought that acquired immunity after an attack of trench fever might persist for six months or longer. But as trench fever is very liable to relapse after several months of well-being, it is very difficult to differentiate relapses from a new infection with the virus.

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#### MEDICAL LIBRARY FOR THE BRITISH EXPEDITIONARY FORCE.

THE British Medical Association has offered to provide a Medical Library for the B.E.F. on the lines of the one already established by the Royal College of Surgeons. The Director-General has asked the Secretary, B.M.A., to convey to the Association our warmest thanks for coming to our assistance in so practical and generous a fashion.

## Clinical and other Notes.

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### SIX CASES OF CEREBROSPINAL MENINGITIS TREATED WITH M & B 693, MILITARY ISOLATION HOSPITAL, ALDERSHOT.

BY MAJOR L. R. H. KEATINGE,

*Royal Army Medical Corps.*

IN the spring of last year, during my short tenure of office at the Military Isolation Hospital, Aldershot, six cases of cerebrospinal meningitis were admitted. Of these, four were bacteriologically proved to be of meningococcal origin. In each case the diplococcus *N. meningitidis* (Group I) was grown from the cerebrospinal fluid. Two cases were diagnosed clinically, but the diagnosis was not bacteriologically supported. The reason for this was that the first specimens of cerebrospinal fluid were sterile, and subsequent puncture was not indicated for the patients' greater good.

All cases had a lumbar puncture performed on them for diagnostic purposes. After that, lumbar puncture was only performed when indicated for the relief of symptoms.

All cases were treated with M & B 693 in varying doses. Three were young soldiers, one an infant girl of 7 months, one a boy of 16, and one a man of 38.

In the treatment of the first of these cases, the importance of heavy initial dosage was not fully appreciated. The small dose given, however, did not retard recovery. This was probably due to the fact that he was diagnosed and got under treatment quickly. In subsequent cases this was rectified, and a heavy initial dose given.

Concentrated antimeningococcal serum was used, chiefly from a disinclination to reject precipitately that which had in the past been found of value. Or, in other words, a desire to give the patient every chance. There was, however, also a feeling that whereas the M & B 693 would kill the organism, the serum would neutralize any toxin already in the system. Serum was not given to any great extent, usually only when lumbar puncture was performed, except in the case of the one patient who was admitted quite unconscious. In three cases, where some of the M & B 693 was vomited, or where unconsciousness made oral administration impossible, soluseptasine was given intravenously and intramuscularly until such time as oral administration of M & B 693 and adequate retention of the drug was possible.

All six cases recovered completely, and comparatively rapidly. The majority of them were inquiring plaintively why they were not getting twice as much breakfast by the second or third morning. In fact a voracious appetite was a marked feature of all cases early in convalescence.

As far as was possible with such a small number of cases, a "routine treatment" was worked out. It was: On admission, lumbar puncture, with replacement by antimeningococcal serum intrathecally, the dose depending upon the amount of cerebrospinal fluid withdrawn. Four tablets of M & B 693 (30 grains) were given by mouth immediately, and repeated in four hours. Thereafter 2 tablets (15 grains) were given every four hours until the more critical period had passed, and then two tablets three times a day until all symptoms had completely disappeared. Lumbar puncture was only repeated when indicated for the relief of symptoms.

*Case 1.*—This patient, a boy aged 16, was admitted to the hospital suffering from a mild attack of rubella, which ran a normal course until the day he was due for discharge. He then had a rigor, and his temperature rose to 106° F. He complained of severe frontal headache and a pain in the neck. He was ejecting a copious brown vomit, was very pale, with rigid neck, and retraction of the head. Kernig's sign was doubtful, but was positive next morning. His pulse was fast, strong, and of good volume. Temperature had fallen to 104·8° F. by evening. Lumbar puncture was performed, and 25 c.c. of fluid of a slight but definite turbidity were drawn off, and 20 c.c. of concentrated antimeningococcal serum introduced intrathecally. The laboratory report showed a great increase of leucocytes—mainly polymorphs; globulin was increased, and sugar not decreased. The centrifuged deposit showed about 90 per cent polymorphs. No Gram-negative diplococci were seen or grown.

He had been given 7½ grains M & B 693, to be repeated four-hourly, but this was almost immediately increased to 15 grains three times a day.

By the evening of the second day his temperature was 98·6° F., and it never rose above 99° F. again, except over a period of one day, when he developed a severe serum rash.

By the evening of the third day all symptoms had disappeared, and apart from the serum sickness he made an uninterrupted recovery and was discharged on leave on the fifty-fourth day.

M & B 693 was discontinued on the sixth day.

*Case 2.*—An infant girl, aged 7 months, was admitted as a transfer from the Louise Margaret Hospital, Aldershot, on April 16, 1939. She had been found to be unwell when taken from her pram the day before. She cried and refused food all night. She was taken to the Louise Margaret Hospital. There she was reported as having her knees drawn up and spastic, her arms flexed and quivering, and pupils fixed. There was neck rigidity, and reflexes were elicited with difficulty. Lumbar puncture was performed, and *N. meningitidis* Group I was cultured from the fluid. Cells were predominantly polymorphs, globulin was increased, and sugar absent. There were a few epithelial cells. Gram-negative diplococci were seen in direct smear.

On admission to the Isolation Hospital she was flushed, her neck was very

rigid, and her head drawn back. Kernig's sign was positive. Her thighs were flexed upon the abdomen, and she gave the characteristic meningeal cry. Temperature was 102.2° F., and pulse 130.

She was given an intramuscular injection of concentrated anti-meningococcal serum, 1 c.c. and 15 grains of M & B 693, in the twenty-four hours. The tablets were powdered and given in four doses. She was much better next morning, having slept most of the night, but resented very much being touched. Temperature had fallen to 101° F. M & B 693 was continued as for the previous day. On the third day M & B 693 was reduced by approximately 4 grains in the day, and was continued for ten days, when it was discontinued. The child improved very slightly during the next five days, and on the sixth day of her illness she had a relapse. Her temperature rose to 102.8° F., and all symptoms were intensified. Lumbar puncture was performed that day and the next, and on each occasion 1 c.c. of concentrated antimeningococcal serum was introduced through the lumbar puncture needle.

On the eighth day temperature had fallen to 100° F., and head retraction, Kernig's positive sign, and neck rigidity had disappeared. On the ninth day all symptoms and signs had gone. Her temperature during the remainder of her stay in hospital was a little irregular at times, and once rose to 102° F., but this was due to teething and the "normal abnormalities" of childhood. She was discharged, fit and well, on May 25, the fiftieth day of her illness.

*Case 3.*—This patient, a man aged 20, reported sick on the morning of April 21, 1939, complaining of abdominal pain and vomiting. He was sent to the Cambridge Hospital, Aldershot, as a query acute abdomen. He was detained, and as cerebrospinal meningitis was suspected, he had a lumbar puncture performed the same morning. A turbid fluid under pressure was obtained. It contained many pus cells, and small yellow clots of pus. *N. meningitidis* was seen in direct smear, and the Group I organism was grown from it.

He was admitted to the Military Isolation Hospital the same day, early in the afternoon. His pulse was 83 and his temperature 101° F. He had severe frontal headache, with pain and rigidity in the neck. There was intense photophobia and vomiting. Kernig's sign was positive, and there was a typical rash on the body and limbs. Patient was semiconscious, muttering, and very ill indeed. Lumbar puncture was carried out, and 10 c.c. of turbid fluid withdrawn and replaced by 10 c.c. of concentrated anti-meningococcal serum. He was also given 20 c.c. of serum intramuscularly. He was given 30 grains of M & B 693, and this was repeated in four hours, and thereafter he was given 15 grains three times a day.

He was vomiting so much on the night of admission that two intramuscular injections of soluseptasine were given, 5 c.c. on each occasion. Vomiting ceased after the second injection, and thereafter M & B 693 was retained by mouth.

On April 23 all symptoms and signs had disappeared, except the rash, which persisted until the following day. His temperature never rose above 98.6° again. M & B 693 was continued for several days after the disappearance of symptoms. Patient was discharged on June 1, the forty-second day after admission.

*Case 4.*—This young soldier, aged 19, was seen by the Orderly Medical Officer, the Cambridge Hospital, Aldershot, on the night of June 11, 1939, and admitted to the Military Isolation Hospital. He was complaining of a severe headache and photophobia. He had a temperature of 102.2° F. and a pulse of 100. There was a pink macular eruption on the back of the wrists and legs. There was some rigidity of the neck, reflexes were sluggish, and Kernig's sign was negative. He had a cough and a sore throat. The Orderly Medical Officer did a lumbar puncture on admission. The fluid was clear and not under pressure. That night he was very restless and comatose at times. Headache was very intense, and he vomited copiously at times. A lumbar puncture was done the next morning, the fluid was turbid, and under pressure 15 c.c. were removed and 10 c.c. of anti-meningococcal serum introduced intrathecally. There was a large number of pus cells in the fluid, Gram-negative diplococci were seen on direct smear and a growth of *N. meningitidis* was obtained on culture. The organism was Group I.

He was given 30 grains of M & B 693, and this was repeated in four hours, and he was then put on 15 grains three times a day. That morning the rash had faded, Kernig's sign was positive, and the headache was intense. He had a pain in his back and his neck was rigid.

During the night of the 12th–13th he slept for long periods and was rational when he awoke, all symptoms were greatly reduced in intensity, and vomiting had ceased. On the 14th the only symptoms remaining were a slight headache and slight stiffness of the neck.

On the night of the 15th he complained of a slight pain in his right knee-cap. He developed a pronounced and painful synovitis of that knee, which continued until June 21, when it began to subside. This was accompanied by a slight fever at times, but there was no pronounced rise after the second day.

On the tenth day M & B 693 was reduced to 7½ grains three times a day, and on the thirteenth day to twice a day. It was discontinued on the seventeenth day.

He was discharged on leave on the forty-ninth day after admission, having made a complete recovery.

*Case 5.*—On June 18, 1939, a N.C.O. aged 38 reported to the Cambridge Hospital, Aldershot, complaining of vomiting and severe headache. He was stated to have been in hospital three months previously as a case of malaria (relapse).

A blood-film was examined that day for malaria parasites. None was seen. There was, however, an 80 per cent polymorphonuclear leucocytosis.

During the next three days the temperature was intermittent. On June 20 another blood-film was examined with similar result.

In the early morning of June 21 he was found to be unconscious. There was slight head retraction, no rash, pupils were equal, but contracted and not reacting to light. Kernig's sign was positive. Lumbar puncture was carried out, and a turbid fluid under pressure was drawn off. Pus cells were present in enormous numbers, and Gram-negative diplococci, extra- and intracellular, resembling meningococci, were seen. On culture a pure growth of *N. meningitidis* Group I was seen.

He was admitted to the Isolation Hospital at 10.30 a.m. on June 21.

■ He was unconscious, with a poor colour and a slow variable pulse. Lumbar puncture was carried out, 15 c.c. of fluid removed, and 10 c.c. of concentrated antimeningococcal serum introduced. Soluseptasine, 5 c.c., was given intravenously, and 5 c.c. intramuscularly. He was given 1 c.c. of camphor in oil at 1 p.m. The laboratory report on the fluid confirmed the earlier report.

At 2.15 p.m. he had another lumbar puncture, and 30 c.c. of serum were introduced. Soluseptasine, 5 c.c., was given intravenously. At 6 p.m. he was given 10 c.c. soluseptasine intravenously, and 40 c.c. of serum intramuscularly. Coramine was ordered to be given every two hours if necessary.

At 10 p.m. lumbar puncture was again performed, and 10 c.c. of serum introduced. Soluseptasine, 5 c.c., was given intravenously. He was incontinent.

The next day (22nd) his condition was unchanged. Lumbar puncture was performed twice, and a total of 60 c.c. of serum was given intrathecally and 30 c.c. soluseptasine intravenously. With the help of a dropper he was given a few minims of brandy. He developed a large crop of herpes round his mouth, which was successfully treated with iodox. He was markedly more sensitive to touch.

On the 23rd the patient showed the first signs of returning consciousness, whilst having lumbar puncture performed in the morning. The sign took the form of an abusive epithet hurled at the operator, and was received with considerable joy by that officer and the nursing staff. He was semi-conscious that day, and slept well that night. He had lumbar puncture performed twice, 30 c.c. of fluid being withdrawn. He had 30 c.c. of serum intrathecally, and 30 c.c. intramuscularly, and 30 c.c. of soluseptasine intravenously. He took fluids well, and had tea and glucose, and brandy. His temperature fell, and his pulse was of good volume.

M & B 693 was first given at 6 a.m. the following day, the 24th. He swallowed it as a powder with considerable difficulty, and from that time was given 15 grains every four hours. Lumbar puncture was not performed that day but was, for the last time, on the 25th, when 20 c.c. of fluid were withdrawn. The fluid was clear. No further serum was given.

On July 8 M & B 693 was reduced to 1 tablet three times a day, the drug being discontinued on July 11.

He remained incontinent until June 27, and all symptoms had cleared up by July 4. The last to go were the incontinence and stiffness of the neck, which persisted long after all pain had gone.

At one period there was considerable anxiety about his mental condition. For many days he rambled, thinking he was in India, and though able to answer simple questions, was defeated by anything involving thought. For example, although he knew his wife by her Christian name, he did not know who was meant by "Your wife," and asserted that, although M—— had been to see him every day, his wife had never been. But his mental condition gradually improved, and he is now as mentally fit as ever.

He was transferred to the Cambridge Hospital, Aldershot, on August 8 for general massage and electrical treatment to hasten his returning strength. This was the forty-ninth day after admission. A blood test was done on June 29, to ascertain if the M & B 693 was doing any damage. It was not. On the contrary, there was a moderate leucocytosis.

*Case 6.*—A young soldier, aged 26, was admitted on June 27, 1939, complaining of severe headache, with pain and stiffness of his neck. Pupils were equal, contracted, and sluggish in reaction to light. Reflexes, generally, were sluggish. There was a positive Kernig's sign. His temperature was 101.4° F.

Lumbar puncture was performed, and the fluid was found to be clear, but under pressure. The laboratory reported the fluid as being normal.

Concentrated antimeningococcal serum was introduced intrathecally—(15 c.c.), and M & B 693, 30 grains, was given. The M & B 693 was repeated in four hours, and then he was given 15 grains every four hours. During the first twenty-four hours a certain amount of the drug was vomited.

Blood showed a marked polymorphonuclear leucocytosis, the total leucocyte count being 25,600 per c.c.

On the second day, the 28th, he again had a lumbar puncture carried out. The fluid was turbid and under pressure. Serum, 15 c.c., was given. He was also given, intravenously, 15 c.c. of soluseptasine. His temperature fell to normal that day, and did not again rise.

On the third day, the 29th, his condition was very much improved; all symptoms were subsiding. M & B 693 was reduced to 15 grains three times a day. During the next two days there was a little improvement.

On July 2 he was very much better, headache and neckache had gone, and he was much brighter. M & B 693 was discontinued on July 4.

That night he had a very bad attack of serum sickness which was, however, afebrile. On the 5th the urticarial rash had faded, and he was much better.

From this time he made a rapid and uninterrupted recovery, and was discharged on leave on August 2, thirty-seven days after admission.

I would like to draw attention to four points of interest:—

(1) In these cases lumbar puncture during the first twenty-four hours

may produce a normal, clear, cerebrospinal fluid. If serum is then given intrathecally the fluid will certainly be turbid the next day. The question then arises whether it would be better to withhold serum and to carry out lumbar puncture again within twelve hours.

(2) There may be an intermittent fever during the acute stage. In Case 5 this served to cloud the diagnosis, in combination with the old history of malaria.

(3) The complication of synovitis in Case 4 is worthy of note. This complication is mentioned in the literature, but is not common.

(4) Case 5 received very large doses of serum. He had 210 c.c. of concentrated serum in three days. In spite of this he never had serum sickness. This patient was so gravely ill on admission, and so very weak when he at last became semiconscious, that one cannot avoid the opinion that had it not been for M & B 693 there would have been another and more rapid termination to his illness.

In cases such as these the new soluble form of M & B 693 will be greatly welcomed.

I would like to say how very grateful I am to the Medical Specialist, Cambridge Hospital, and to the Assistant Director of Pathology and the staff of the Leishman Laboratory for all their help and advice, without which I would not have been able to achieve what was, in effect, a happy ending.

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## INTENSIVE TREATMENT OF GONORRHOEA WITH M & B 693.

BY MAJOR T. P. BUIST,  
*Royal Army Medical Corps.*

AND

CAPTAIN R. H. SIMON,  
*Royal Army Medical Corps.*

A REPORT on M & B 693 in the treatment of gonorrhœa by Bowie, Anderson, Dawson and Mackay, of Aberdeen, was published in the *British Medical Journal* of April 8, 1939.

It concluded with a record of a notable experiment in intensive treatment on 23 cases by what they termed the "8.4.2 treatment."

A supply of M & B 693 was received for use in the venereal division of the Military Hospital, Gibraltar, in August, and it was decided to experiment with "8.4.2," as local garrison conditions appeared particularly appropriate for the purpose.

The results to date have so exceeded expectations that it is felt that a preliminary report is justified to direct attention to the "8.4.2 treatment" as one which appears to have definite military importance, and therefore deserves more extensive trial. Should fuller experience confirm that these results are dependable, the treatment of gonorrhœa in the Services, both in peace and in the field, will assume an entirely new aspect.



Twenty consecutive cases of ordinary fresh gonorrhœa cases have been treated, with an average of 5.3 days in hospital, and only one relapse so far.

The routine used in this hospital is as follows :—

(1) *Diagnosis* by microscopic examination of smear.

(2) *M & B 693*.—On diagnosis 4 grammes (8 tablets) ; followed in four hours by 2 grammes (4 tablets) ; followed in four hours by 1 gramme (2 tablets) ; thereafter 1 gramme four-hourly during waking hours—normally 6, 10, 2, 6, 10. The treatment is stopped at the end of seventy-two hours, whether the case is dry or not, and amounts normally to a total of 17 grammes. No lavage is given. Cases are kept in bed for the first twenty-four to forty-eight hours.

(3) *Diet*.—Milk diet (excluding eggs) for twenty-four hours. Thereafter, ordinary diet (eggs and onions excluded).

(4) *Control*.—(a) On admission : General examination ; smear ; urine ; blood picture. (b) Daily : Smear ; urine ; blood picture. (c) Fourth day : Prostate examination.

(5) *Discharge from hospital* to duty and surveillance, as soon as there is no discharge and the urine is clear.

(6) *Surveillance*.—Daily for first week, thereafter weekly for two to three months. Surveillance includes further prostate examinations, blood pictures, and urethroscopy ; also routine Wassermann reactions.

*Toxic Effects*.—The absence or trivial degree of these in face of the heavy dosage given has been remarkable. In less than half of the ordinary fresh cases treated there has been admission of slight headache during the first night ; a few cases have admitted slight nausea on the evening of the first and the morning of the second day ; one of them vomited on the morning of the second day. None had any further discomfort.

Incidentally, in one case, not in this series, a relapse after treatment with sulphonamide P. headache, pyrexia, and vomiting occurred after 13 grammes of M & B 693. These disappeared on discontinuance of the drug. This case did not respond.

Repeated examinations of blood-films did not reveal any material change in the blood picture.

Except for the mildness of the toxic reactions, due possibly to the initial treatment in bed, the clinical progress of the cases has corresponded closely with that described in the Aberdeen report.

The following extracts from two case cards are illustrative and typical :—

No. 651. Exposure 16.8.39.		Onset 26.8.39. No previous V.D.	
Age 30	M & B 693 tabs.	Urethral Discharge	
27.8.39	— 8.4.2. = 7 gm.	P. + +. G.C. +	Bed. Milk diet.
28.8.39	2.2.2.2.2. = 5 gm.	N.S.A.	Kahn and W.R. negative
29.8.39	2.2.2.2.2. = 5 gm.	Dry	Urine clear
30.8.39	—	Scanty discharge Ep only.	Up. Urine clear—two shreds
			Shreds : Scanty P. cells.
			Prostate and vesicles normal
31.8.39	—	Dry	Urine clear
			To duty and surveillance
Surveillance uneventful.			

No. 790. Exposure 13.9.39. Onset 23.9.39. No previous V.D.

Age 33	M & B 693 tabs.	Urethral Discharge	
23.9.39	-- 8.4.2. = 7 grm.	P. ++. G.C. ++	Bed. Milk diet
24.9.39	2.2.2.2.2. = 5 grm.	P. + Ep +. No organisms	
25.9.39	2.2.2.2.2. = 5 grm.	Dry	Kahn and W.R. negative
			Up. Ordinary diet
26.9.39	—	Dry	Urine clear. Prostate and vesicles normal
			To duty and surveillance

Surveillance uneventful.

**Relapses.**—Only one has occurred so far. The following extract from his case card shows an apparently normal response to the treatment :—

No. R.N. 443. Exposure 24.9.39. Onset 3.10.39. No previous V.D.

Age 19	M & B 693 tabs.	Urethral Discharge	
4.10.39	-- 8.4.2. = 7 grm.	P. ++. G.C. ++	Bed. Milk diet
5.10.39	2.2.2.2.2. = 5 grm.	P. +. Ep few. G.C. scanty	Up. Ordinary diet
6.10.39	2.2.2.2.2. = 5 grm.	P. +. Ep few. No organisms	
7.10.39	—	Sperm. ++. Ep few	
8.10.39	—	Dry	Prostate and vesicles normal
9.10.39	—	Dry	To duty and surveillance
Relapsed 12.10.39. P. +. Ep +. G.C. +.			

Since writing this report we have received the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS for October, 1939, containing the report of Captain J. M. Officer on 40 cases treated by him in Shanghai.

His results appear to tally very closely with our own experience.

Our present report has been made to draw attention to the Aberdeen "8.4.2 treatment" and deals only with uncomplicated fresh cases.

#### SUMMARY.

Attention is directed to an intensive form of treatment with M & B 693 for gonorrhœa reported in the *British Medical Journal* of April 8, 1939.

A preliminary report is made on 20 consecutive uncomplicated fresh cases treated by this method and averaging 5.3 days in hospital, with the suggestion that more extensive trial is deserved.

We have to thank Colonel M. J. Williamson, M.C., D.D.M.S., Gibraltar, and Lieutenant-Colonel C. J. Blaikie, R.A.M.C., Commanding Military Hospital, Gibraltar, for permission to submit this report for publication.

#### A CASE OF SEVERE GENERALIZED DERMATOSIS TREATED BY SULPHONAMIDE.

By ETHEL BROWNING, M.D.

IN view of the opinion expressed in several recent publications that neither sulphanilamide nor sulphapyridine (M & B 693) give very favourable results in generalized skin infections, the following record of a case of impetiginous dermatitis, presenting some unusual features and responding well to sulphonamide therapy, may be of interest.

Twenty consecutive cases of ordinary fresh gonorrhœa cases have been treated, with an average of 5.3 days in hospital, and only one relapse so far.

The routine used in this hospital is as follows :—

(1) *Diagnosis* by microscopic examination of smear.

(2) *M & B 693*.—On diagnosis 4 grammes (8 tablets); followed in four hours by 2 grammes (4 tablets); followed in four hours by 1 gramme (2 tablets); thereafter 1 gramme four-hourly during waking hours—normally 6, 10, 2, 6, 10. The treatment is stopped at the end of seventy-two hours, whether the case is dry or not, and amounts normally to a total of 17 grammes. No lavage is given. Cases are kept in bed for the first twenty-four to forty-eight hours.

(3) *Diet*.—Milk diet (excluding eggs) for twenty-four hours. Thereafter, ordinary diet (eggs and onions excluded).

(4) *Control*.—(a) On admission: General examination; smear; urine; blood picture. (b) Daily: Smear; urine; blood picture. (c) Fourth day: Prostate examination.

(5) *Discharge from hospital* to duty and surveillance, as soon as there is no discharge and the urine is clear.

(6) *Surveillance*.—Daily for first week, thereafter weekly for two to three months. Surveillance includes further prostate examinations, blood pictures, and urethroscopy; also routine Wassermann reactions.

*Toxic Effects*.—The absence or trivial degree of these in face of the heavy dosage given has been remarkable. In less than half of the ordinary fresh cases treated there has been admission of slight headache during the first night; a few cases have admitted slight nausea on the evening of the first and the morning of the second day; one of them vomited on the morning of the second day. None had any further discomfort.

Incidentally, in one case, not in this series, a relapse after treatment with sulphonamide P, headache, pyrexia, and vomiting occurred after 13 grammes of M & B 693. These disappeared on discontinuance of the drug. This case did not respond.

Repeated examinations of blood-films did not reveal any material change in the blood picture.

Except for the mildness of the toxic reactions, due possibly to the initial treatment in bed, the clinical progress of the cases has corresponded closely with that described in the Aberdeen report.

The following extracts from two case cards are illustrative and typical :—

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28.8.39	2.2.2.2.2. 5 gm.	N.S.A.	Kahn and W.R. negative
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Surveillance uneventful.			

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25.9.39	2.2.2.2.2. = 5 grm.	Dry	Kahn and W.R. negative
			Up. Ordinary diet
26.9.39	—	Dry	Urine clear. Prostate and vesicles normal
			To duty and surveillance

Surveillance uneventful.

*Relapses.*—Only one has occurred so far. The following extract from his case card shows an apparently normal response to the treatment :—

No. R.N. 443. Exposure 24.9.39. Onset 3.10.39. No previous V.D.

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6.10.39	2.2.2.2.2. = 5 grm.	P. +. Ep few. No organisms	
7.10.39	—	Sperm. ++. Ep few	
8.10.39	—	Dry	Prostate and vesicles normal
9.10.39	—	Dry	To duty and surveillance
Relapsed 12.10.39. P. +. Ep +. G.C. +.			

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#### A CASE OF SEVERE GENERALIZED DERMATOSIS TREATED BY SULPHONAMIDE.

By ETHEL BROWNING, M.D.

IN view of the opinion expressed in several recent publications that neither sulphanilamide nor sulphapyridine (M & B 693) give very favourable results in generalized skin infections, the following record of a case of impetiginous dermatitis, presenting some unusual features and responding well to sulphonamide therapy, may be of interest.

Two special points may be noted :—

(a) That premature cessation of dosage brought about an immediate relapse in the general condition of the patient, though not in the skin lesions.

(b) That the patient was not seen, and the treatment with sulphonamide therefore not begun until eleven days from the beginning of the spread of the lesion, and until pyrexia and general toxæmia were already well established.

This is interesting in view of the opinion expressed recently (Rautz and Keefer, 1939) that the duration of fever, in erysipelas at any rate, is not likely to be shortened by sulphonamide if treatment is begun after the third day, because by the fourth day the local lesions are fully developed, and cure must then take place by the natural defences of the body. The course of this case under two separate periods of sulphonamide therapy does not appear to bear out this view.

*History of the Case.*—The patient, H. Y., a man aged 50, weighing between 18 and 19 stone, had had for some months sore, crusted areas (? impetigo) at the corners of the mouth. He believed he had scratched these and transferred the infection to the scalp, where it spread fairly rapidly forming a crusted inflammatory covering. Lotio hydrarg., followed by a dusting powder, had been applied. A few days later the whole face became œdematous, both ears inflamed, with purulent discharge oozing from the meati, and both eyes affected by a severe conjunctivitis. Two days later an eruption appeared all over the body.

*Condition on First Examination.*—General condition : The patient was very drowsy, but complaining chiefly of intense pain in the eyes, especially the left. Temperature  $101^{\circ}$  F.; pulse 100 and slightly irregular; urine contained no albumin or sugar; blood-pressure 140/100.

The teeth, of which only 14 remained, were in extremely bad condition; every one decayed, and the gums intensely pyorrhœic. There was a large dental ulcer on the outer surface of the right alveolar margin.

The face : The whole face was very red and swollen. The corners of the mouth and the chin were covered with pustular crusts extending down the front of the neck and into and behind both ears, from which a serous discharge was oozing.

The eyes : The eyelids of both eyes were red and swollen, the swelling of the left eye being so great that the patient was unable to open it. The conjunctiva of this eye was so deeply injected as to suggest a subconjunctival hæmorrhage.

The scalp : The hair and the purulent crust were matted into a complete hard thick covering extending over the whole scalp.

The body : The chest, arms, abdomen, and thighs were covered with a deep purplish-red patchy eruption. Some of the patches on the chest had fused together and formed areas of ulceration. The axillæ and groins were red, moist, and oozing. The back was covered with a diffuse, scarlatiniform itching eruption.

The pharynx was deeply congested ; the tongue was furred in the middle with a strawberry appearance round the edges.

*Treatment and Course of the Condition.*—December 27, 1939 : Local treatment consisted of starch poultices to the scalp, chin, and crusted areas of the face, followed by applications of ung. hydrarg. ammon. The abdomen, arms, chest, and thighs were bathed with a 5 per cent tannic acid solution ; to the back, axillæ, and groins was applied a lotion of calamine in oil.

Sulphonamide P was given—an initial dose of 15 grains, followed by 7½ grains, four-hourly during the day.

December 28 : Perhaps the most striking feature of this case was the rapidity with which the skin lesions began to subside on administration of sulphonamide. Within twelve hours of the first dose the œdema of the eyelids and the conjunctivitis had subsided sufficiently to allow the patient to open his eyes and recognize surrounding objects. Within twenty-four hours the purplish rash on the front of the body had begun to fade. The temperature fell to 99° F. on the next day, and with the exception of a rise to 100° F. on January 1, remained normal until January 3.

January 3, 1940 : Lesions on face, scalp, and trunk were subsiding well, the scarlatiniform rash on the back was replaced by a fine desquamation, the arms and chest beginning to exfoliate.

The patient complained of sore throat ; pharynx much inflamed, and strawberry tongue more pronounced.

A blood-count showed a leucocytosis (16,000) with a red cell count of 3,000,000. Hæmoglobin 60 per cent.

In view of the marked improvement in the skin condition and the fall of temperature, and with due regard to the cases of agranulocytosis and aplastic anæmia reported from even moderate dosage of sulphonamide in the presence of idiosyncrasy, it was decided to cease dosage.

January 4 : Temperature rose to 100° F., and for the next two days ranged between 100° F. and 101° F.

January 6 : The patient was very drowsy and obviously toxæmic, though the skin lesions were stationary.

Sulphonamide P, 7½ grains, four-hourly, was recommenced.

January 6–11 : Temperature 100° F. morning, and 101–102° F. evening ; patient very drowsy but unable to sleep at night ; complaining of headache, intense malaise, and sore throat.

January 12 : Two injections of prontosil soluble (20 c.c. of 5 per cent solution) given intramuscularly, at six-hour intervals. Sulphonamide P continued four-hourly. Evening temperature 103° F.

January 13 : Temperature had fallen from 102° F. at 2 a.m. to 99.2° F. at 8 a.m., but rose in the evening to 101.4° F.

Two more injections of prontosil soluble were given.

January 14 : The temperature fell to 100° F. within twelve hours, and then to normal, and with the exception of one evening rise (100.2° F.) on

the 16th remained normal thereafter. All sulphonamide therapy was stopped on the 14th.

For two or three days after the first injection of prontosil the patient was slightly cyanosed, and complained of nausea and intense malaise—the “depressed” condition familiar to all who have used any of the sulphonamide group of drugs. By January 18 this had subsided, the skin, after extensive exfoliation, was practically normal with the exception of a few slightly inflamed patches on the scalp, and the general condition was greatly improved. Blood-count: R.B.C. 4,000,000; leucocytes, 6,500; Hb. 70 per cent.

It was decided to have the teeth, which were an obvious potential source of re-infection, extracted as soon as possible, and a week later a prophylactic dose of sulphonamide P (15 grains) was given four hours before the extraction of seven teeth under gas. The same evening there was a slight rise of temperature (100° F.); the next morning it was normal. The remaining seven teeth were extracted a week later without any previous dose of sulphonamide P, and with no further interruption of smooth progress to complete recovery. The gums healed with remarkable rapidity.

#### SUMMARY.

(1) A case of generalized dermatosis, probably impetiginous and streptococcal in origin, responded to sulphonamide treatment instituted on the eleventh day from the beginning of the spread of the infection.

(2) Relapse occurred after an initial improvement following a total dosage of 180 grains (12 grammes) in six days, on cessation of dosage.

(3) Improvement was not noticeable on resumption of sulphonamide P but was rapid and striking when combined with prontosil given intramuscularly. The total dosage of sulphonamide P during the second course of treatment was 335 grains (22.5 grammes) during a period of eight days, and of prontosil soluble 80 c.c. of the 5 per cent. solution.

(4) Fourteen teeth, showing gross pyorrhœa, were extracted without any flare-up of infection, and with rapid and complete healing of the gums and alveolar tissues.

#### REFERENCE

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## Echoes of the Past.

### TWENTY YEARS AFTER.

By H. SKIPTON STACY, M.D., Ch.M.(Syd), F.R.A.C.S.

*Honorary Consulting Surgeon at Sydney Hospital, Ryde Hospital, and Royal South Sydney Hospital.*

(Continued from p. 176.)

#### COMMENTS MADE IN 1937 AFTER REVIEWING THE NOTES.

*Acute Pyelonephritis.*—Case 5.—This figures as a cause of one death. It was a sacral wound in which frequent catheterization was needed; infection ensued. Under more favourable surroundings and trained female nurses, possibly infection might not have supervened. (The patient was looked after by a male nursing orderly.) Whether drugs such as prontosil, etc., or ammonium mandelate would have controlled the infection, I do not know.

*Multiple Intra-abdominal Lesions.*—Apart from the fact: (a) That the chest is often involved as well as the abdomen; (b) that there may be muscle, vessel, or bone wounds elsewhere, there are many cases of multiple abdominal lesions, e.g. bowel and bladder, Cases 63, 52, 36, and 6. Colon, spleen, and stomach, Case 42. Bowel, spleen, and kidney, Case 35. Also it is quite common to have multiple wounds of the alimentary canal, e.g. Cases 55, 54, 52, 31, 29, 8, 7, and 6.

*Liver.*—Injuries to this are illustrated in Cases 53, 48, 38, 16, and 13. It is quite frequent in thoraco-abdominal injuries. It is remarkable how—where there is a coincident wound of the diaphragm—the latter will contract down upon the liver wound and restrain the hæmorrhage; in no case was this excessive.

*Spleen.*—Wounds of this were not common; presumably many died on the Field. Cases 42, 35, and 12 were examples, but even in Case 12, where the spleen was lacerated, there was only a teacupful of blood (fluid) in the peritoneal cavity; however, there was, in addition, much blood-clot tracking down the wall of the descending colon, and a handful of clot around the spleen itself. This case also had a hæmopericardium and hæmothorax; he died immediately after admission; otherwise he would have gone on bleeding. Cessation of hæmorrhage from splenic injuries is a very deceptive affair, as we know too well from civilian injuries; it is very apt to recur.

*Bladder.*—The sepsis resulting from bladder wounds was very severe—whether it was cellulitis from extraperitoneal wounds, or peritonitis from intraperitoneal ones; it was very apt to be fatal, e.g. Cases 63, 52, 36, 27, and 6.



*Hæmorrhage.*—Cases in which death ensued as a result of abdominal hæmorrhage alone were not common; these would not reach a clearing station. There were many in which it was a contributing factor. The largest collection was seen in a shrapnel wound of the stomach. In this case, No. 37, I think death was due to hæmorrhage in the abdominal and pleural cavities; he was conscious to the end. The temperature (or absence of it) was not as helpful as the pulse. No. 8 also showed a large hæmorrhage. There was one case of an intraperitoneal hæmorrhage (not of great amount) which appeared solely due to a contusion of the diaphragm from the passage of a shrapnel bullet through the pleural cavity. Case 46 showed intraperitoneal hæmorrhage from a wound in the left part of the diaphragm; the missile had missed the viscera. The treatment of hæmorrhage has improved considerably since 1917. Early in that year at the Front, we were giving an occasional transfusion (incidentally without proper testing of the donors). In 1918 the organization of transfusions was much improved, and there were teams devoted to that purpose, but much has been done since those days. In some big American hospitals there are members of the staff who are occupied solely in giving transfusions from morning till night. At the Front, using a combatant as a donor, and giving him "ten days' leave in Blighty" as a reward, is a somewhat wasteful method. I can visualize the day when we will have at the Front squads of donors, comprising men who have been rejected on enlistment, but who are free of any infective disease, and who would be perfectly suitable for such a purpose. As to the exact methods, citrated blood has replaced whole blood, and Kimpton's tubes are rarely seen now. Marriott and Kekwick, of Middlesex Hospital, have shown that a pint of blood only augments the hæmoglobin value by 10 per cent; hence larger transfusions are very frequently indicated. These can be given by the method of "continuous drip" which they have described. The Russians have also been devoting much attention to the subject in recent years, and use "stored blood" taken from the bodies of those who have met with violent deaths; it is preserved for a period. Such a method, it seems to me, would add immensely to the usefulness of blood transfusions, because it would be time-saving, and thus frequently life-saving.

Regarding the "storing of blood," some interesting observations had been made at the meeting of the Association of Clinical Pathologists reported in the *British Medical Journal* of June 26, 1937. Doctor Norah Schuster (London) said that the red cells in the ordinary citrated blood remained intact for about twenty-one days, after which hæmolysis began. They could be kept longer by adding glucose to the blood, and in certain physiological fluids they had remained intact for 190 days. Red cells were still physiologically active in the circulation of a recipient animal after having been kept for fourteen days; they could also be kept for four weeks and retain their power of absorbing oxygen.

By the Russian method of storing blood taken from a cadaver a few hours

after sudden death, large quantities could be collected from the donor, and there was no need for the addition of citrate on account of fibrinolysis.

The medical service of the Government forces in Spain in the course of the rebellion, were using stored blood in ampoules under a positive pressure of two atmospheres for emergency work. The blood was usually of Group A or O, and was administered straight into the vein from the ampoule, as a rule by medically unqualified orderlies or nurses. The period for which it was kept was three to four weeks. Experience shows that there was no likelihood of damage from infection or the development of toxins in blood stored for one month.

*Retroperitoneal Hæmorrhage.*—This was not uncommon ; where it was retrocolic it was not usually of very great size, and rarely infected ; but one large case of retroperitoneal hæmorrhage, accompanying a wound of the hepatic flexure, became gas-infected (probably from the contents of his own colon) and died ; the wound of entry was through the loin. Like most of the gas-infected cases, he was mentally clear to the end, and did not live long (in this case about forty-eight hours after admission). I think I am correct in saying that these are usually cases of toxæmia rather than septicæmia.

One case of perinephric hæmorrhage from a wound of the kidney gave a shadow in the radiograph which was not interpreted correctly until after death (Case 53).

A contributing cause of death in one case of a right-sided retroperitoneal hæmorrhage was shock ; one of its effects was a marked distension of the large bowel from the cæcum to the splenic flexure, where it ended abruptly (Case 49). Shock in this region is great, owing to the involvement of the sympathetic plexuses. Nowadays it is thought that the shock accompanying severe cases of pancreatitis is due to this cause.

*Shock.*—The outstanding feature of the abdominal wounds was the accompanying shock ; this was always increased by turning them about much on the operating table, or by taking them to the X-ray Room. In the C.C.S. of the future there should be portable X-ray outfits.

The problem of how to treat these abdominal wounds in the best manner is, I think, far from solved ; of course, it hinges around the most effective method of treating shock, and getting them into a condition to stand severe operative measures. First of all, as regards the anæsthetic. The advocates of narco-local anæsthesia would, I expect, advocate this in place of a general anæsthetic, and for their point of view there is something to be said ; on the other hand, these cases need careful searching to ascertain the extent of their injuries, and I am extremely doubtful that this can be sufficiently attained by narco-local. (Of course it depends to some extent on the experience of the one who is giving it.) It is also a time-consuming method. Spinal anæsthesia is unsuitable, as it causes too much fall in blood-pressure.

Are the modern anæsthetics, e.g. cyclopropane, or a skilfully given

nitrous oxide and oxygen, going to solve the problem ? I am very hopeful of the former.

Blood transfusion is best for those cases of shock combined with hæmorrhage.

We gave intravenous infusions of saline by the ordinary (fairly rapid) method ; it seemed to pull them round temporarily, but their condition subsequently was worse than before. I think a great improvement on this is the continuous intravenous drip glucose and saline, or of gum acacia and saline : this would demand team work such as I have indicated above for the blood transfusions.

The Army authorities in 1917 established abdominal operating stations forward of the clearing stations. This had the advantage of lessening shock by cutting down the length of transport, and thus enabled operation earlier, before the leakage had caused much peritonitis.

*Subphrenic Abscess.*—Case 42 illustrated this ; it resulted from a wound of the spleen and splenic flexure. Although he had other lesions, they were not infected. Possibly if it had been recognized earlier, he might have been saved. Case 29 was also a subphrenic abscess resulting from a wound of the splenic flexure.

*Peritonitis.*—In few cases could it be said that peritonitis alone was the cause of death ; it was rarely advanced enough. Shock from the multiple injuries and from the operation was a contributing factor.

*Bronchopneumonia.*—This occurred in Case 29, in which the primary infective lesion was in the abdomen : he had a perforating wound of the splenic flexure and stomach, with pus formation : he lived seven days. The organisms found in the lungs were the *Bacillus aerogenes capsulatus* and the pneumococcus.

*Technique for Small Bowel Wounds.*—First of all we will note Nature's method of closure. We are familiar with extrusion of the mucosa of the bowel into the wounds in order to prevent extravasation. (This acts for a while, during the inhibition of peristalsis.) But it was also seen in wounds of the liver and diaphragm, where the liver would be found extruding itself into the diaphragmatic wound in order to seal it. Cases 13 and 38 are illustrative of this.

Experience seems to indicate that it is wise to explore the whole alimentary tract first, surrounding the perforations as you go with a small pad (the tape going through the mesentery). Then decide whether the multiple suture or resection is wiser, remembering that the shock from the latter is greater.

If resection is decided upon, is it to be end-to-end or lateral anastomosis ? It seems as if the latter gives the best results, provided the redundant mucosa is clipped away ; distension of the proximal segment seems less after this method than after end-to-end ; but I am inclined to think that, in addition, the insertion of a small tube or large catheter (such as a De Pezzer) shortly above the anastomosis is a wise precaution ; if passed through omentum,

the enterostomy wound will close more rapidly. It has been suggested to me that the methods which Mikulicz applied to the large bowel might be adopted in gunshot wounds of the small bowel. I think there is much to be said for this, because ideal procedures are frequently out of place at the Front.

*Bile in the Peritoneal Cavity.*—In Case 53 the X-rays showed a honey-combed appearance throughout the abdomen. The post-mortem revealed much distension of coils of the bowel which were adherent in many places by flakes of bile-stained lymph; there was also much bile-stained lymph on the posterior wall of the abdomen, and some free bile in the right kidney pouch.

(To be continued.)

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## Current Literature.

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FULLER, A., AND JAMES, E. V. **Dosage of Sulphanilamide Prophylaxis of Wound Infection.** *Lancet*, March 16, 1940.

The possibility of preventing wound infection by hæmolytic streptococci, to which we have lately drawn attention in the JOURNAL, has been investigated by the authors of this paper. They say they have no previous experience of preventive chemotherapy in man, but the many therapeutic investigations that have been carried out enable them to formulate certain guiding principles:—

(1) A certain concentration of the drug must be maintained in the blood for several hours or days if the invasive tendency of the organisms is to be held in check.

(2) Since sulphanilamide is rapidly absorbed and eliminated doses must be given at short intervals or some means must be found of securing continuous absorption.

(3) The more serious the infection the higher the blood level of the drug needs to be.

(4) Treatment must be given as early as possible, for the greater the delay in therapy after the onset of the infection the higher the blood-level needs to be.

(5) Since these drugs are not devoid of toxic effects, and many of the wounded will be suffering from shock and may have lost much blood, it is important to use the smallest amount of the drug which is likely to afford protection.

For a given concentration in the blood the best results are obtained if the sulphanilamide is given previous to infection. Four hours' delay halves the number of survivors at a given concentration of the blood. Litchfield, White and Marshall found that with immediate therapy two-thirds of the

mice which had received 200 lethal doses of Group A hæmolytic streptococci recovered if the concentration of sulphanilamide in the blood is kept at 1-5 mg. per 100 c.c. With four hours' delay a concentration of 6 mg. per 100 c.c. saves only half the animals. A level of 6 mg. per 100 c.c. does not save any animals who have received 20,000 lethal doses four hours before treatment begins.

In applying these results to man Fuller and James recall that man has a certain immunity to hæmolytic streptococci which the mouse lacks. Further, the conditions of experimental infection are much more severe than in accidental wound infection where the implant usually consists of only a few cocci not actively growing nor accompanied by nutrient substances, and applied to a place where diffusion throughout the body does not take place readily. They consider it probable that a concentration of 1.5 mg. of sulphanilamide per 100 c.c. of blood would be adequate for prophylaxis provided it could be given not more than an hour or two after wounding. They have, however, chosen a level of 2 mg. per 100 c.c. as the minimum concentration desirable. It is important that this level should be reached quickly and be maintained during the whole of each successive period of twenty-four hours. If several hours elapse before a wounded man can be treated, the first three or four doses should be increased to ensure a higher concentration of sulphanilamide in the blood. Sulphanilamide is fairly soluble and rapidly excreted; if a big dose, 5 g., is given, much of it is excreted in eight hours. Fuller and James tried to get a longer effect by employing specially coated tablets of sulphanilamide. The tablets tried had a granule coating of shellac, some had a further coating of shellac on the outside (double coated), or with keratin to delay absorption until the gut had been reached. Ordinary tablets were coated with collodion to provide a permanent film through which the drug could dialyse. A dose of 1.5 g. was used and all tablets were 0.5 g. Proseptasine was also tried as a means of securing delayed production of sulphanilamide, for a single dose is followed by the excretion of sulphanilamide in the urine for two to five days. The resulting concentrations of the drug in the blood were on the average higher for the plain tablets than for any of the coated ones. The results from proseptasine varied most of all. The percentage excretion in forty-eight hours of the amount given was: Plain tablet 82.6, single shellac coating 60.0, double shellac 59.0, collodion 20.0, keratin 3.0, proseptasine 4.6. The coatings did cause delay in absorption, but owing to incomplete absorption they gave no resultant advantage. With regard to rapid absorption 1.5 g. of sulphanilamide was given (1) in a hot solution in 100 c.c. of a 1 per cent solution of citric acid flavoured with glucose, and (2) in intact 0.5 g. tablets. The concentration in the blood was then determined and it was found that the solution gave an advantage of between one and two hours over the intact tablets.

Tests were then made to see how often the doses must be given to maintain a steady concentration of sulphanilamide in the blood. The first

dose (1.5 g.) was given in solution for rapid absorption and starting two hours later, when the concentration of sulphanilamide was maximal, one intact tablet of 0.5 g. every four hours. The concentrations rose above 2 mg. per 100 c.c. in the first hour and never fell below that level. These concentrations were considered adequate for prophylaxis. Fuller and James therefore recommend a first dose of 1.5 g. dissolved in warm sweetened 1 per cent citric acid solution, followed two hours later and then every four hours by an intact 0.5 g. tablet. After this time the difference between dosing every four hours and dosing every eight hours is not great, and 1 g. every eight hours could be substituted without any great loss of efficiency, provided that intact tablets were given. The citric acid increases the solubility of the drug and assists rapid absorption; it disguises the unpleasant flavour of the drug, and citrates and glucose are probably acetate precursors and would allay the immediate toxicity of the drug.

The results obtained with coated tablets were very disappointing. Although the tablets remain in the gut for twenty-four to forty-eight hours, the absorption of sulphanilamide from them becomes very slow after eight hours, by which time they have reached the colon, from which only a small amount of water is absorbed. Of the 6-10 litres of water absorbed from the gut 94 per cent is absorbed from the small intestine. For this reason the absorption of sulphanilamide cannot be delayed for more than a few hours if absorption is to be complete. Sulphanilamide is apparently non-irritant and can be absorbed from wound surfaces. Jensen, Johnsrud and Nelson found that a packing of 5-15 g. of sulphanilamide prevented sepsis in compound fractures.

Fuller and James, in the summary of their paper, state their experiments support the recommendations of the War Office for the prophylactic use of sulphanilamide in war wounds. As already mentioned, they recommend that the first dose should be 1.5 g. given in solution for rapid absorption, and that the succeeding 0.5-g. doses, starting two hours after the first dose, should be given four-hourly as intact tablets to prolong their effect. It is essential that the first dose be given as soon as possible after wounding to combat the gas-gangrene organisms which are implanted at the time of injury and develop quickly. Further, prophylaxis must be continued for four days at least, as many of the hæmolytic streptococcal infections may not be caused at the time of wounding but later in hospital. If several hours have elapsed before treatment begins the first few doses should be increased. The use of proseptasine or of coated tablets to secure more prolonged retention of the drug does not at present seem to offer any advantages.

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## Reviews.

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**TUBERCULOSIS AND NATIONAL HEALTH.** By H. Hyslop Thomson, M.D., D.P.H. London: Methuen and Co., Ltd. 1939. Pp. x + 259. Price 10s. 6d.

This book is well worthy of perusal by those interested in medical social problems.

The ground is adequately covered ; the letterpress is good—an important item in these “ black-out ” days—and there is a helpful summary at the end which epitomizes in a succinct manner the conclusions arrived at.

The relative incidence and significance of human, bovine, and avian tuberculosis in man and other animals are first discussed ; also the relationship of the various types of acid-fast organisms other than tubercle bacilli. The interesting hypothesis is advanced that “ the human type of bacillus represents the evolutionary end-result of saprophytic acid-fast bacilli which, under normal conditions of life are non-pathogenic but which, through long and close contact with man under altered conditions of life, have assumed pathogenic characters.” Yet another example, if true, of mutation.

In discussing the incidence of clinical tuberculosis in this country the author remarks on the progressive fall in the death-rate from the disease which has taken place since the middle of the last century, except during the period of the Great War, when there was a rise. We must see to it that there is no similar rise during this war.

In a chapter dealing with the care and employment of the tuberculous patient Dr. Thomson makes the trite remark that “ the chief aim of care and supervision is to maintain the individual with arrested or quiescent tuberculosis as a cog and not a clog in the machinery of national life.”

In a section dealing with early detection, reference is made to the close and well-established connexion between erythema nodosum and tuberculosis. Mention is made of one group of 800 Swedish school children with erythema nodosum studied by Wallgren. 95 per cent of this group gave a positive tuberculin reaction compared with 25 per cent given by a control series.

The characteristics and implications of epituberculosis, a recent arrival in the field of medical nomenclature, are dealt with.

A short but adequate account is given of the manifold activities both of the Papworth Village Settlement and of the British Legion Village at Preston Hall. The latter is of special interest to readers of this journal since two-thirds of the patients are ex-Service men.

In an interesting chapter devoted to tuberculosis and the nursing service the author calls attention to the fact that most nurses who have developed tuberculosis have been negative to tuberculin when first taking up the duty of nursing tuberculous patients. In consequence, he suggests that a nurse who is taking up this duty should give a positive reaction to tuberculin while, of course, presenting not the slightest evidence of clinical infection.

There is one paragraph in the author's summary which, in view of present circumstances, merits close attention :—

He says " War, especially when prolonged, leads to increase in the incidence of tuberculosis. Resistance is impaired by strain, fatigue, trauma, and interference with the normal supply of food ; while the risk of infection is increased by overcrowding and the mass movement of population."

One hopes that, as far as the present war is concerned, and in view of the general exodus of at any rate the younger members of the community from the overcrowded towns to the open country, the good and the bad will, as near as may be, cancel out, and that the steady downward curve in the incidence of tuberculosis of pre-war days will be maintained, or even accelerated, possibly because of, and not in spite of, the war. S. S.

**PATHOLOGICAL HISTOLOGY.** By Robertson F. Ogilvie, M.D., F.R.C.P. Edin. Edinburgh : E. and S. Livingstone. 1940. Pp. 332. With 220 photomicrographs in colour. Price 27s. 6d.

Knowledge of pathological histology can only be acquired by studying actual preparations under the microscope. No book can ever replace this method of procedure, and it is most important that the student, before commencing a study of the subject, should master the rudiments of microscopic technique so that he may derive the maximum benefit from the instrument. It takes many months, if not years, of diligent study peering down the microscope at large numbers of sections of tissue before the student gains experience sufficient to enable him to express an opinion with confidence on the changes present.

In the early stages of the training in this specialized branch of medicine, the teacher is often uncertain that the student, when viewing a section under the microscope, is really looking at the correct area which he should study. In order to overcome this and assist the undergraduate in the initial stages of his training, and also the graduate seeking more highly specialized knowledge of the subject, Dr. Ogilvie has produced a book, the main feature of which is the large number of photomicrographs in colour. These represent in a most realistic way what is actually seen with the microscope, and lavishly illustrate the text. There is no doubt as to the value of this method of presenting a subject that is essentially a practical one, and it is certain to appeal to both student and graduate alike.

The volume is concerned with the tissue changes produced by those diseases most commonly met with in Great Britain, and is designed to act as a companion to a standard textbook of pathology. The general lay-out follows the lines adopted by a number of books on the subject, and the text is based on a series of lectures delivered at Edinburgh University.

The detail of the microscopic changes in each condition is preceded by a brief account of the macroscopical appearances that are present ; this greatly enhances the value of the book. The descriptions are concise and clearly expressed, and the author has succeeded in emphasizing the essentials



of the pathological processes not only in his descriptions, but also in the 220 coloured photomicrographs which he has selected to illustrate his text. The pictures are reproduced from actual coloured photographs of stained sections and are made from Finlay colour transparencies. Their reproduction is extremely good.

The author is to be congratulated on producing such a useful book, the popularity of which is assured.

**AN OUTLINE OF MEDICAL PSYCHOLOGY.** By E. Fretson Skinner, M.A., M.D., F.R.C.P. London: H. K. Lewis and Co., Ltd. 1939. Pp. viii + 173. Price 6s. net.

As a brief introduction to psychology, always assuming that one accepts the broad principles enunciated by Freud, this little work could hardly be bettered.

In his preface the author makes no claim to originality and states, modestly, that the book is written for the help of medical students.

In this respect it may be said to share a quality inherent in many a children's play or fairy story (not that the book resembles a fairy story), namely that, whilst written primarily for the young, it has an almost equal appeal for their elders.

The student days of many of the "elders" of medicine were passed during the "dark ages" of psychology, when this new science had not yet fully emerged from its egg (some consider it has not yet emerged). Those amongst us labouring under this disadvantage are also in debt to Dr. Skinner for he has written his message clearly and in simple language, making little use of the long words and involved phrases, often amounting to a meaningless jargon to all but the "initiated," so often met with in works on this subject.

The author is to be congratulated on having produced a sane and well-balanced introduction to a difficult subject. S. S.

**FOOD VALUES AT A GLANCE AND HOW TO PLAN A HEALTHY DIET.** Second Edition. By Violet G. Plimmer. London: Longmans, Green and Co., Ltd. 1940. Pp. 190. Price 6s. net.

All those concerned with catering, whether for a family, a school, or a larger community, will welcome this new edition of a popular book on the important subject of nutrition.

It presents in simple and clear form a concise and instructive survey of the general principles of nutrition, but makes a point of not being too technical. The numerous tables and coloured charts in the book are admirable and really do show at a glance the essential characters of the common foodstuffs.

The text has been revised and brought up to date in this edition. Some new charts and tables containing practical data concerning the average vitamin content of foodstuffs and a few new sections have been added. An index has also been provided.

The book, which is of general interest to medical officers and laymen alike, should prove invaluable to those who wish to apply the newer knowledge of nutrition in planning diets on a physiological basis. We strongly recommend the book to all those interested in the subject of nutrition which in time of war becomes of the first importance to all communities.

F. McK.

**SURGERY OF THE HAND.** By J. H. Couch, M.A., M.B., F.R.C.S.Ed. (Department of Surgery, University of Toronto). Oxford University Press : Humphrey Milford. 1939. 29 semidiagrammatic illustrations. Pp. xii + 147. Price 7s. net.

There is no doubt that the advice of those who write on this subject should be cried daily in the market square or from the house (or factory) tops. Disablement following infection introduced into the hand through some trivial skin lesion, is still far too common ; too often, unfortunately, delayed or misguided treatment has been largely responsible. This is not just another book on the hand, but is unique in the experience of the reviewer in that it is written by a surgeon who has specialized in the subject during the last ten years, working at Toronto, under the watchful eye of Professor Gallie, who writes the foreword. The substance is essentially practical ; there is a welcome absence of minute anatomical detail, which too often forms a useless padding in books which profess to be practical. Part I concerns injuries, and in Chapter 2 the author makes an illuminating statement. The cost in hard cash of the working days lost in one year to the State of Ontario alone is computed at 133,000,000 dollars ! Part II deals with infection ; the author recommends certain modifications of the generally accepted principles, which are sound and interesting. This is a first-class little book, clearly written, essentially practical, and well illustrated.

D. C. M.

**SULPHANILAMIDE AND ITS DERIVATIVES IN THE ROUTINE TREATMENT OF GONORRHOEA IN THE TROPICS.** Bulletins from the Institute for Medical Research, Federated Malay States, No. 5 of 1938.

This report embodies an attempt to assess the value of these new drugs in the treatment of gonorrhœa. The material is from the poor native classes in the Malay States ; these patients are bad attenders at hospital, and usually receive the minimum of treatment. To follow up this type of patient is also practically an impossibility, so that a period of controlled observation is a rarity. However, the Malayan presents, in respect to the effective treatment of gonorrhœa and its complications, a major medical problem. The cases on which this report is based number 138—all in-patients ; none had local treatment to the urethra. The amounts of the drug given and the failures (27 per cent) are higher, and the incidence of the toxic reactions (10 per cent) lower, than the figures published by many other workers. This may possibly be due to a lower power of response of the individual

under treatment. The writer notes the rapid response in cases suffering from general complications. Of 40 cases treated with uleron, the results are disappointing as compared with those following sulphanilamide.

A study of the leucocyte counts in the series under review appears to show that the white cell-count and the percentage of polymorphs are restored to normal during administration of the drug, any initial abnormality being corrected.

No cases have been reported on as treated with M & B 693 in the above series.  
D. H. M.

**FIRST-AID TO THE INJURED AND SICK.** Seventeenth Edition. By Warwick and Tunstall. Edited by F. C. Nichols, *M.C.*, *M.B.*, *Ch.B.*, *M.R.C.S.*, *L.R.C.P.*, *L.D.S.*, late Captain *R.A.M.C. (T.)*. Bristol: John Wright and Sons, Ltd. 1939. Pp. xvi + 328. Price 2s. 6d. net.

This is one of the very best books on this subject, and the fact that it has now reached its seventeenth edition speaks for itself. It is an extremely comprehensive book, but manages to keep very much to the point. The section on Gas Poisoning in Warfare has been brought up to date and contains all the essentials in a concise form. This book can be thoroughly recommended.  
C. C.

**STRAIGHT TIPS FOR "SUBS."** Fourteenth Edition. By the late Captain A. H. Trapman. Revised to date by Major J. Seymour Rouse. London: Forster, Groom and Co. 1939. Pp. xxxix + 72. Price 1s.

This snappy little book should be in the pocket of every young man who aspires to a commission in the Army. It is now in its fourteenth edition, and it is difficult to see how it could be improved.  
C. C.

**TEST QUESTIONS AND MODEL ANSWERS ON FIRST-AID.** By E. S. Brawn, *M.R.C.S.*, *L.R.C.P.* London: George Gill and Sons, Ltd. Price 6d.

This is a useful little book. The questions are practical and the answers are very much to the point. Any first-aider, knowing all these answers, would have quite a good general knowledge of his job.  
C. C.

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## Correspondence.

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### NOMENCLATURE OF BLOOD GROUPS.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

We have received the following letter from the Ministry of Health:—

DEAR SIR,—As the British member of the Health Committee of the League of Nations, I have been asked to draw your attention to the following resolution passed at the meeting of this Committee on November 20–25, 1939:—

“The Health Committee believes it to be its duty once more to draw the attention of all concerned to the recommendation adopted by the Permanent Commission on Biological Standardization in 1928 concerning the nomenclature to be adopted in the designation of blood groups. It is of opinion that, especially in present circumstances, the use of a uniform nomenclature will obviate mistakes which might entail serious consequences.”

In 1928, the Permanent Commission on Biological Standardization reported that :—

“The Commission learns with satisfaction that, on the initiative of the Health Organization of the League of Nations, the nomenclature proposed by von Dungern and Hirsfeld for the classification of blood groups has been generally accepted, and recommends that this nomenclature shall be adopted for international use, as follows :—

O    A    B    AB

To facilitate the change from the nomenclature hitherto employed, the following is suggested :—

Jansky	O(I)	A(II)	B(III)	AB(IV)
Moss	O(IV)	A(II)	B(III)	AB(I)

The Commission recommends the adoption of the following method of designating test-sera :—

Test-serum A (anti-B)  
Test-serum B (anti-A)

Test-serum A (anti-B) should be placed in containers of white glass, test-serum B (anti-A) in containers of brown glass.

The Commission having learned that in certain countries this nomenclature was not yet in current use, emphasized the importance of achieving uniformity in the matter. The Commission believes that this object might be attained : (a) If each institute which supplies standard sera used solely this nomenclature ; (b) if the editors of scientific journals (medical, legal, etc.) insisted upon the exclusive use of this nomenclature in all the works they may be called upon to publish. It is particularly desirable that all the more important weekly medical journals should also conform to this rule.”

The attention of the Health Committee had been drawn to the question by the Danish member, who stated that authoritative British medical journals had recently published articles in which the old nomenclature had been used.

Yours faithfully,

NEVILLE M. GOODMAN, M.D.

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## CONTENTS

	PAGE		PAGE
ORIGINAL COMMUNICATIONS.		CLINICAL AND OTHER NOTES.	
Surgery in the Army. By Lieutenant-Colonel D. C. MONRO . . . . .	249	A Case for Diagnosis. By Major G. F. HARRISON, R.A.M.C. . . . .	292
Epidemic Influenza. By Major C. H. STUART-HARRIS, M.D., M.R.C.P., R.A.M.C. . . . .	270	Vth C.C.S. Medical Society. Second Meeting . . . . .	299
Notes on Treatment of the Rheumatic Diseases in the B.E.F. By Major W. S. C. COPEMAN, M.D., F.R.C.P., R.A.M.C. . . . .	277	ECHOES OF THE PAST.	
EDITORIAL.		Twenty Years After. By H. SKIPTON STACY, M.D., Ch.M.(Syd.), F.R.A.C.S. . . . .	300
War Nephritis . . . . .	286	CURRENT LITERATURE . . . . .	304
		REVIEWS . . . . .	306
		NOTICES . . . . .	311

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## Original Communications.

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### SURGERY IN THE ARMY.

BY LIEUTENANT-COLONEL D. C. MONRO.

*Royal Army Medical Corps.*

"In the multitude of middle-aged men who go about their vacations in a daily course determined for them in much the same way as the tie of their cravats, there is always a good number who once meant to shape their own deeds and alter the world a little. The story of their coming to be shapen after the average and fit to be packed by the gross, is hardly ever told in their consciousness; for perhaps their ardour in generous unpaid toil cooled as imperceptibly as the ardour of other youthful loves, till one day their earlier self walked like a ghost in its old home and made the new furniture ghastly. Nothing in the world more subtle than the progress of their gradual change! In the beginning they inhaled it unknowingly; you and I may have sent some of our breaths toward infecting them, when we uttered our comforting falsities and drew our silly conclusions: or perhaps it came from the vibration from a woman's glance."—(MIDDLEMARCH.)

As each January comes round the surgical specialist in the Army must prepare his annual report on the work of his department during the year that has just ended. Ultimately his report reaches the Consulting Surgeon to the Army, who has the unenviable task of reading it, together with others like it, and extracting therefrom such information as he requires to enable him to compile the surgical section of the Annual Report of the Health of the Army. Should he feel annoyed when a surgeon's report fails to bring out succinctly and in a uniform manner the facts and figures he requires, who shall blame him? In fact, all such formal reports make dull and boring reading. To the surgeon who compiled it, on the other hand, this simple return of numbers of operations performed, with brief notes on fatalities, cases of interest, etc., is a human document. To him, it is the story of his

surgical trials, triumphs, and disappointments during the year. It reminds him of moments, even hours, of brow-moistening strain, of emergency calls in the dead of night, of past perplexities and, even more, of numerous exhibitions of pluck and endurance on the part of patients under the stress of pain and suffering. He remembers with justifiable pride and gratitude occasions when his "team" was instrumental in assisting Nature to coax back a life from the very brink. How many surgeons, having completed such a report, have not sat a while and pondered, conscious of a tendency to inquire within or even to indulge in self-recrimination?

It so happens, that after over twenty-five years of active participation in surgical work in the Army I find myself, for the first time, with no annual report to render. Prompted, doubtless, by the realization of this fact, I took down an old file which contained copies of most of the reports I had submitted yearly, and as I committed the contents one by one to the waste-paper basket, such relief as I felt was tinged with regret as I reviewed in memory the past years when I, too, had been one of a "number who once meant to shape their deeds and alter the world a little." But there is no profit in regret. Time marches on! Nevertheless, I dare say that few senior officers do not wish occasionally that they were again serving during their jollier junior years, and struggling with some of the problems which then faced them.

Those old documents represented considerable experience, and I was reminded of the way in which experience as it accumulated had assisted me to tackle many difficulties which I had encountered in later years. Then I began to wonder whether it would not be possible to turn such experience to some further account. Could I write an article dealing with personal experiences and private views on some aspects of surgery in the Army, without laying myself open to criticism? Might not the uncharitable reader fail to perceive an altruistic motive and regard such action as unwarrantable presumption? Because I believe that such an article could assist junior surgeons and might be of interest to other officers in the Corps, I intend to risk criticism and attempt it. Much of my own experiences as well as the views I shall express are shared by surgical colleagues in the Corps, and I trust that the reader will not regard this article as an autobiography, but rather as an attempt to touch superficially on the later history of surgery in the Army, with the improvements in connexion with it that have taken place during the last quarter of a century. Dean Inge in "Social Aphorisms" says: "Individual experience is always one-eyed. It takes more than one man to see anything in focus." This is true; so that in presenting somewhat monocular ideas on the subject, I must leave it to those who may care to read them to provide the other eye, and determine for themselves whether there is anything useful in the stereoscopic view.

Three months before the Armistice in 1918 I found myself posted to India, and not long after arrival was appointed surgical specialist to a district in the Deccan. As yet unqualified according to regulations for such an

appointment at home, this post abroad carried with it extra pay at the rate of 2s. 6d. *per diem*. I had just left one of the pivotal surgical field units, a casualty clearing station in France, where for the previous eighteen months I had been in charge of a "surgical team." About thirty of us, newly joined regulars, were required in India to relieve those who had been there for five years or more. I remember being frankly disappointed with the comparative paucity of equipment and the conditions under which one was expected to work. There had been no lack of surgical equipment in France, in fact it would not be an exaggeration to say that team surgeons had been rather spoilt in this respect. Such a state of surgical affluence was due to concerted action by civilian surgeons from all over the Empire, who were working in the operating centres in the field. Many of these young men were brilliant and survived to fill important positions in later years. The enormous numbers of casualties meant that surgeons were in general demand: "The doctors must have what they want" was almost a slogan. It took me some time to realize that I was now to work under a different system of finance and that improvements in equipment and supplies were likely to come about only slowly in a country which had been affected to a less extent by the war.

The operation room at the hospital where I was to work was in a semi-detached hut connected to the two main surgical wards by a roofed-over footpath; an arrangement satisfactory enough in that warm climate in calm weather, but those who have served in India know that the worst of the monsoon rains and dust storms come upon one with remarkable rapidity. A boiler at the back of the hut provided hot water at forty minutes' notice, and the H.P. sterilizer was heated by a primus stove. Lamps with incandescent mantles provided artificial light. I remember one senior officer parrying my criticism of this arrangement by stating that he had assisted at several operations at one station in India, a few years previously, performed on an outside verandah screened off from the gaze of interested onlookers by carbolized sheets, and that the cases had done well in spite of the fact that the sheets failed to keep out dust and flies. I heard stories concerning C.O.s of the "old school" who regarded the removal of belt or tunic while working in surgical wards as a relaxation of discipline calling for reprimand. Spurs and leggings were worn in the operating theatre. I wore a clean white coat in the wards, but such action was regarded at first as ostentatious. While checking the surgical instruments I came across several horn-handled "tools."

Demobilization followed soon afterwards, and there was keen competition on the part of those due to be released to proffer claims for priority. It was difficult to persuade many that an army cannot be demobilized in a month, and grievances were voiced publicly. Although there had been a reduction in the strength of the local garrison, the hospital staff had to work very short-handed, until the demand on shipping lessened and the necessary reinforcements of medical personnel could arrive. I shall never forget an incident

about this time. Late one afternoon I was informed that the General Officer Commanding-in-Chief was being admitted, and that he had been accidentally struck in the back of the hand by shot from a scatter gun, while out after snipe. Radiograms showed thirty-six pellets of No. 8 shot among the small muscles and tendons of the back of the hand. My concern and forebodings may well be imagined. However, fortune favoured our efforts, and we were able to remove all but two deeply placed pellets, and the General, being of the good old tough school, and a most delightful and obedient patient, healed well, the injury leaving trivial disability. I sometimes think that had it been otherwise my readers might have been spared this article! This operation required a minimum of instruments, but it reminds us that given a healthy optimistic patient, and luck, it is possible to obtain useful results with the barest surgical necessities.

A year later I was transferred as surgical specialist to another command, where two-thirds of the effective forces of the Army in India are situated: one nearer the Frontier. There had been trouble with Afghanistan and the Frontier tribes, and some fighting, so we had an occasional battle casualty. The equipment of the hospital was more up to date. Nevertheless, there were problems and difficulties to overcome, and not the least of these was the influence of precedent and established custom in the changeless East. I hope it will be realized that these particulars are mentioned not only as part of the history of those months in 1919-20, but also in order to emphasize that great and beneficial changes began in 1921, the year after the submission of the annual report from which these verbatim extracts are taken, and that they have since continued.

#### *"Anæsthetics.*

The only alternative to a rapidly dwindling stock of ether, which I am told was supplied 'specially for the war,' is chloroform. I fail to appreciate why it should be considered necessary to supply ether only during war time. The excuse I have heard put forward, that ether is wasteful because it evaporates too fast in this hot climate, is ridiculous, in my opinion. Apart from the fact that long administration of chloroform may well be dangerous in certain cases, such as those with hepatitis, or suffering from chronic sepsis, ether is a much safer anæsthetic. The climate here in the cold months or in the Hills is just like that of the U.K."

At this time there were no specialists in anæsthetics, and as often as not one had to depend on the occasional volunteer amateur to administer chloroform by means of an antique "safety first" apparatus designed by Vernon Harcourt for just such amateurs, and stated to be fool-proof.

#### *"Nitrous Oxide.*

It would be difficult to overestimate the value of even a limited supply of  $N_2O$ , with an apparatus for administering it. Apart from its safety, pleasantness to take, and absence of after-effects, it is easy to administer, and its use would save much time and labour. Used in combination with oxygen, it was in constant use in France, and is also extensively used in all the leading civil hospitals of the world."



Nitrous oxide was supplied shortly afterwards, and it can be imagined what a popular addition it made.

*"Local Anæsthesia (Regional and Infiltration).*

Stovain (spinal) and various other proprietary drugs or preparations have to be obtained by 'local purchase' in small amounts, at exorbitant prices, when it would appear that they could be purchased wholesale by the Indian Government at contract rates, and retailed by stores at half the price.

[*Note.*—It is noted that both Ether and Kerocain (Tabs. gr.  $\frac{1}{3}$ ) appear in a list of *surplus* medical stores, published by Controller of Sales, at \_\_\_\_\_ dated August 1921."]

*"Treatment of Fractures.*

One is at times faced with the treatment of fractures with incomplete union in bad position, transferred to this hospital, when, to quote my letter of 2 months ago, every available means has failed to retain the fragments in an extended and reduced position, and the case is sent here 'for further treatment. ? Operation.' In many cases the utmost ingenuity has been exhibited by M.O.s who have been previously treating the case in their efforts to splint the limb and extend the fragments. Nevertheless, the patient often arrives here with his fracture semi- and mal-united, the skin broken with pressure sores and blisters where various retentive apparatus, strappings or glues have been applied. The underlying cause of failure in this class of case is that, in the heat of this climate, not only will various extension strappings or glues fail to hold, but the skin, being in poor condition from sweat-gland infection, easily blisters and sloughs, and each successive means of extension attempted, is effective only long enough to do harm in the end by permitting recurring and intermittent movements. The remedy suggested is the immediate transfer of fracture cases to a hospital, where the fragments can be reduced by open operation or by extension applied direct to the bone. The latter method is preferable."

*N.B.*—Sir Arbuthnot Lane's open methods were in vogue at the time. Somewhere in one of my boxes there is an old riding stirrup which the local ordnance officer kindly converted into a tolerable imitation of an extension calliper, with which I treated several fractures of the femur with average results.

*"Thomas pattern leg splint.*

The Officer Commanding the Station Hospital at \_\_\_\_\_ (a subsidiary Out-Station in the District, some 130 miles distant) stated the other day, that he has no Thomas splint on charge and is not entitled to one 'on the equipment scale.' It is hard to believe that this could be so when the Station is the headquarters of a cavalry brigade and a horse battery."

So much for my first tour of India. On completion of my five years' tour abroad I returned to home service, and soon after attended the senior promotion course at the Royal Army Medical College, and was fortunate enough to be able to satisfy the College Council that I was fit to specialize in surgery. During the latter six months I did an excellent Fellowship Course at St. Thomas's Hospital and duly qualified as a surgical specialist, and was then entitled to draw, at home also, the special rate of pay (still only 2s. 6d. *per diem*) when employed in that capacity.

Since then I have completed another tour in India, and I shall always regard those two tours as embracing some of the most interesting, most strenuous, and happiest years of my service.

#### SURGERY AS A CAREER IN THE CORPS.

Very naturally, one is often asked by junior officers for advice on the question of taking up surgery as a career in the Corps. My reply has usually been that I, personally, have never regretted it, though at times I have felt that the work was rather more strenuous than I liked and that there have been numerous occasions when I felt that one was terribly tied by it in comparison with officers specializing in some other branches of our work.

It is necessary that aspirants should appreciate the advantages and disadvantages of taking up surgical work as a special subject in the Army.

As to the former : In the first place we deal mostly with fit young men in the prime of life, so that we get little of the surgery of senility. Of our patients, officers retire at the age of 55 or 57, and other ranks go to the Army Reserve while still in early middle age. Compared with civil hospital work, we get less of the surgery of malignancy, though there would appear to have been a definite tendency in the last ten years or so for this fell disease to affect younger soldiers. Female surgery is limited by the comparatively small numbers of married men and the officers' families, but when the officer in charge of the military families' hospital is not a practising surgeon, a proportionate increase in the numbers of this class of case will fall to the surgeon. Much of our work deals with the effects of trauma or pyogenic infection.

Our organization is such that we get our acute and urgent cases early. Then again, it is a definite advantage, when appointed to a station or command, to be assured of comparative fixity of tenure. The appointment is usually for three years, and it is the exception for military exigencies to intervene and necessitate an unforeseen move. We work in a good climate as a rule, avoiding most of the hot weather in stations abroad by accompanying our patients to the more salubrious climate of a hill station. Consideration for the comfort of the patients, rather more than for that of the surgeon, demands such an arrangement. Finally, the main surgical centres are situated in the more populated and important stations, where there is plenty of life going on around one, and no dearth of opportunity for recreation and sport if one has time to participate. Private practice is permitted, but only on the strict understanding that it involves no expenditure of Government time or material.

Now for the disadvantages. Too often one is the only surgeon in the station, and this means ploughing rather a lonely furrow. There is a natural tendency to regard an only surgeon as indispensable, and although he is usually excused from doing his share as orderly medical officer, in reality he is constantly on duty and is apt to be overworked. At times, too, one experiences a tendency to compare one's lot with that of a few more fortunate

brethren in civil life, who get fat fees for performing many operations for which the Army surgeon's only extra remuneration is (now) 5s. a day. On the other hand, a fixed income is assured and there is a pension to look forward to. When consideration is given to the opportunities for work, recreation and social intercourse with those of the same station in life, to the fact that it is often possible to obtain two months' leave per annum (and one period of six months during a foreign tour) or sick leave on full pay, and without the necessity to employ a locum tenens, who would wish to change places with the average surgical colleague in civil life ?

#### THE TRAINING OF A SURGEON.

In a recent address from the chair of the Medical Society of London (delivered on October 9, 1939) and published by the *British Medical Journal* on October 21, 1939, Mr. Zachary Cope made many essentially sound statements under the heading "The Profession of Surgery." Of the surgeon he said :—

"To no man was the destiny of human life so often delivered. As judge he had not only to give the verdict but himself to carry out the sentence.

"It must be admitted that the surgeon could not be standardized any more than the general practitioner, but it should be possible to ensure a greater minimum knowledge and experience in everyone wishing to become a surgeon. The responsibility of the profession to the public was such that adequate guarantees as to sufficient training of anyone wishing to practise major surgery should be furnished. . . . It was probably true that in none of the higher British surgical qualifications was supervised practical experience sufficiently insisted on as an essential preliminary for a candidate. Some qualifications indeed were open to the criticism that they seemed more in the nature of competitive examinations than tests designed to demonstrate a candidate's skill and experience in surgery."

The possession of a special surgical degree is not essential for junior officers who wish to specialize, but a surgical Fellowship of one of the colleges will not only entitle him to prior consideration but also ensure that he is employed in surgical work as soon as it is established that he can put his theoretical knowledge into practice. To have had practical surgical experience would be a factor of value, but one of the most important assets that a prospective candidate can possess is that he shall have served an apprenticeship for at least six months as house surgeon to a recognized master of the art. On joining, an officer may be seconded for a period to enable him to obtain such training. For the rest, his anatomy book should be his medical bible, he should have confidence in his nerve, "good hands," sufficient conscience, and a sense of responsibility. With experience he will gain in assurance and inspire confidence. A surgeon is more often born than made. The best surgeon has a natural flare for the work. Have we not all seen men with the highest surgical qualifications who have none of these natural aptitudes ? Some who are wise enough to appreciate their limitations will not handle a scalpel ; others, alas, with less perception,



muddle and burrow through an operation, using many of their instruments after the manner of shovels or tyre levers !

Under the recent Short Service Commission regulations, a junior officer who has given proof of sufficient experience may be graded "surgeon," after recommendation by competent authority and approval by the R.A.M. College Council. If thereafter employed on specialist duties in a station which is entitled to a surgeon on peace establishments, he may draw the extra allowance which the appointment carries. Under normal circumstances the special qualification is not granted until the candidate has obtained qualifying marks in the various subjects at the senior promotion course at the College, and has passed the special examination in surgery which will follow. In preparation for this he has what is tantamount to a fellowship coach course lasting six months, and for which the Army pays all fees. The newly qualified surgeon should be posted to a station to work for his first six months under a senior surgeon, whenever such an arrangement is possible. In my experience, this plan has not only been popular with the junior officers, but of considerable value to them. Those of us who have worked in London, freely acknowledge the added feeling of confidence which the presence not only of the Consulting Surgeon to the Army, but, also of the several Honorary Consultants to Queen Alexandra Hospital, gives them. I have long felt that our appreciation of the unsparing and entirely voluntary assistance which our honorary consultants in London have always rendered, might be recorded in some more tangible manner.

India is a fertile training ground for our young surgeons. If a junior officer in one of the more isolated stations can acquire a passing knowledge of the local language and customs, and gain the confidence of those in the locality, he will find a wealth of opportunity and material and gain in experience and self-reliance.

Most surgeons working in India have felt the need on occasion for an Army surgical consultant. By simply touring to inspect the surgical divisions in hospitals, and getting to know the surgeons working under him, he could do useful and valuable work. But the vast distances he would have to travel in case of emergency, even should the local government emulate the "flying doctors" in Australia by providing aerial transport (a most unlikely supposition !), would not only tend to render his help in person ineffectual, but would certainly reduce the number of applicants for such a post to an insignificant and rather heroic few. In many districts where Royal Army Medical Corps surgeons are employed there is an experienced officer on the civil side of our sister Service, the Indian Medical Service, who is both capable and willing to help if required. A courtesy call and a "bak" about "shop" is always appreciated, and a profitable alliance results.

Once a year each officer is reported on through the medium of his confidential report. This raises a difficult question. How is a commanding officer, who makes no pretence to special surgical knowledge, to appraise

the work of his surgeon? At all events, the reporting officer will be a man of experience, who is unlikely to be influenced by a mere account of numbers of operations performed. He will be uninfluenced by fatalities without full consideration of the facts concerning them. He will know how much weight to give to local reputation, and will not be misled by station gossip. He will weigh industry and conscientiousness against the state of the waiting list for operation and the "turn-over" of the wards. He will be particularly influenced by the organization of the surgical work, the morale and confidence in the surgical wards, and the causes which led to invaliding. Surgical semi-invalids with little chance of ever returning to full duty should not be kept hanging about in the station to swell the numbers of those "constantly sick" when there is little prospect of their recovery in under six months. The junior surgeon should study the war organization of the medical services, and by reading official medical history should attempt to visualize the conditions under which he may have to work in war-time. The value of advances in surgical knowledge should be assessed in terms of their applicability to conditions in the field. As regulars, our principal function in war is to assist in the organization.

#### POSTED.

When posted to a station to fill a surgical vacancy the newly qualified specialist's troubles have really begun. Arriving at his destination he will be instructed to report to the senior executive medical officer, who will take an early opportunity of presenting him to the officer in command of the garrison. In due course he will proceed to the military hospital to report to the officer commanding, and will be conducted round the premises and given useful general information concerning his duties and life in the station. Whenever possible, and this is almost invariably so, he should take over from his predecessor in person, seeing the cases during a personally conducted tour of the wards. Should the station be small or second class he will be expected to take his share in the general medical duties. In a larger station, however, he will be a very busy man, constantly on call, and should be excused, as he generally is, from taking his turn on the roster of orderly medical officers (O.M.O.s). It not infrequently happens that the "new man" has to take over from a surgeon of repute, who is not only popular but enjoys the confidence of the station, and whose departure is obviously regretted. People are wont to be thoughtless or tactless enough to say so, openly, in the new man's presence. Little wonder that at such a time he is apt to feel aware that his own reputation and that of the Corps, will probably depend on a "lucky break," and that the successful handling of his first few important cases will make or mar him. Strange how often over-anxiety or ill-luck will tip the scales against a man under the circumstances!

He should then check over his equipment and get to know his theatre staff. It is a mistake to rush a strange staff with a host of instructions concerning personal preference in theatre routine and the preparation of

cases for operation. This only fusses everyone, and such changes as are deemed necessary can be brought about gradually. Any special instructions concerning routine after-treatment are best communicated in writing and issued to the sisters in charge of the wards, as routine orders. A courtesy call should always be made on the matron or senior sister. Her co-operation can be assured, but an informal talk will reveal many ways in which the general conduct of the work can be furthered, such as restricting operations to certain days to enable the staff to have their off-duty periods.

Nowadays, fortunately, most C.O.s appreciate that it is generally impracticable, particularly in a busy station, for the surgeon to report daily to him at a stated hour. It should be sufficient for the C.O. to know that his surgical adviser will keep him informed and is available for interview concerning such problems as may arise, when not engaged on his primary duty of attending to his cases. Routine work is always arranged to a fixed programme, which is drawn up so as to fit in with that of the other specialists (ear, nose and throat, medical, etc.).

The contents of the splint room should also be checked, and it is a good plan to pay a friendly visit to the neighbouring medical stores depot to see the reserves and mobilization equipment. Make a point of never hoarding superfluous stock, and see that no items which require repairs or replacement are allowed to accumulate.

In most stations in India surgical work is transferred to the associated hill station for the hot weather (May to August). The surgical unit moves up as a team, complete with instruments, etc., leaving a reduced emergency set of instruments in the plains in charge of the second theatre orderly, who remains there.

On occasion it may be necessary to visit one of the out-stations. The surgeon's services may be required for a consultation with the local M.O. or to operate on a case. Though generally unavoidable, these journeys upset routine or a prearranged programme in an annoying way. On the other hand, they may provide a welcome change of scene, and in latter years have been made occasionally by air. Any train journey in the heat in India is tiring and often uncomfortable, and it is not inclined to improve the temper when you are told on arrival that the case you came to see is dead.

The problem of providing for treatment of cases of hæmorrhage is nowadays simplified. A list of registered local volunteer blood donors is available in the theatre, and it is the duty of the officer in charge of the district laboratory to see that the volunteers are available, and their numbers kept up to requirements.

The first whole blood transfusion I saw was carried out by members of the Harvard Medical Unit (Drs. Denis Crile, Alton, and Fish) at a casualty clearing station in France in 1916. The old paraffin-coated Kimpton tube was used. Later the citrated method was in common use, and of many cases I have since seen resuscitated in this dramatic manner, the one that sticks out most vividly in my memory occurred later, when the victim was

the late Lieutenant Osler, son of his distinguished father. We had no listed donors and I had to go round a convalescent marquee with a hurricane lamp in the dark, asking for a volunteer. The operation enabled the patient to regain consciousness and carry out a longish intimate conversation with his godfather, the late Harvey Cushing, before Professor Darragh and Dr. Brewer (both of U.S.A. M.S.) operated skilfully on a forlorn hope.

An important duty for which the surgeon is responsible is the selection and training of operating room attendants. The first is more often easier said than done. The candidate should be a first-class nursing orderly if possible. Too often it happens that the man you would like is one of the mainstays in the wards, and the nursing staff is loath to let him go. Considerable collaboration is required between the company officer, the matron, and yourself. Here it is essential to get a man who is smart, conscientious, keen, and trustworthy. He must be fond of the work, and realize that he holds a position of responsibility and one which is confidential. It should never be allowed to hinder his advancement, no matter how much it upsets the running of the work. Whenever he can be spared from the operating theatre he should accompany you on ward rounds and with the senior nursing orderlies, there to be instructed or questioned on the cases and problems connected with each. Your senior ward orderly should know the diagnosis of each case in his ward, and the basis of treatment and your operating room attendant should know about each case which has been operated on, and about the progress of them. Make all your instruction interesting and practical, and above all, train the powers of observation and anticipation.

#### ADVICE ON THE ORGANIZATION.

*Out-patients.*—Two half-days in the week are usually occupied in seeing out-patients (O.P.s). At this stage let me say that one of the soundest bits of advice I can give any specialist, or for that matter any officer in the Corps, is to purchase and learn to use a portable typewriter. A specialist, in particular, has a good deal of writing to do, and if you happen to be one of a number who use a particular form of calligraphy, which might be styled "all your own," the adoption of a typewriter as a means of conveying your thoughts to paper will be welcomed by all colleagues and most friends. At all times in professional work, a typewritten document is more business-like. Another, and perhaps the greatest advantage, is that you can so easily duplicate reports and letters and keep a copy for your personal file, at the same time saving yourself the annoyance, especially at the end of a long day when you are hot, tired, and irritable, of having to scan and correct the efforts of one of the less proficient babus (Indian clerks) who are capable of making the most imperial hash of our technical words.

The surgeon's consulting room or the office he uses as such should adjoin the operation room. The out-patient waiting room, X-ray department, plaster room, and massage department, should be in close proximity or in the same block. One of your operation attendants should be trained as

usher and chief assistant. He can prepare such examination instruments as you generally use, and can rapidly obtain or sterilize others from the theatre, which is his own domain.

*Out-patient Register.*—The detail of numbers and categories of the cases you see as out-patients, is required for both monthly and annual surgical reports, so that it is essential to keep records either by a card index system or in a register. I have always favoured the latter as it is efficient, less expensive, and a suitable book (A.B. 22) for the purpose can be obtained from the hospital office. This book is indexed, alphabetically at the back. Regulations for the Medical Services of the Army (Regs. M.S.A.), paras. 558 and 563, indicate the information required, and how the sections of your register should be split up. Each case is given a serial number, and the series is continuous for the year. Names are always written in block capitals, followed by initial, rank, last three figures of the Army number, and then the unit. The next line is left blank for the diagnosis, then follow notes on previous health, history, signs, and symptoms. In the case of commissioned, warrant, or non-commissioned ranks, I have at times entered the rank first; the same with "Mrs." or "Miss." Children should all be entered as "S/o" or "D/o" (son or daughter of, etc.). At the end of the session your orderly indexes the cases, again in block letters, and the diagnosis is included in the index to facilitate looking up a series of cases by diseases. At the end of each month he totals the cases for the period under their appropriate headings, and then carries on the total figures to the end of the year. Whenever it becomes necessary to write at length on a case, for instance a letter to a colleague, or a report for the president of a medical board, copies of such reports are kept and filed separately, a note to the effect that this has been done being made in the out-patient register, beside the appropriate entry.

Out-patients, generally, can be grouped as follows :—

(1) Consultation cases : These cases are sent up for your opinion as to the diagnosis, treatment, or fitness for duty or service.

(2) Minor surgical cases, the treatment of which is beyond the scope of the equipment of the unit or regimental inspection room (M.I. room).

(3) Follow-up cases : In other words, cases you have seen on a previous occasion either as out-patients or hospital admissions, and which you are keeping under observation.

(1) *Consultation Cases.*—The principal duty of the Unit (or regimental) M.O. during his sick parade, is to decide whether a man is fit for duty on that particular day. His inspection takes place early in the morning, when the N.C.O.s are beginning to detail men for various duties. It is often a question of picking out the fit men quickly, and examining sick ones more fully and at leisure. When there is a somewhat unpleasant duty detailed in battalion orders for the day, such as a route march, inspection, etc., and the weather is bad, it takes a man of experience, backed up by a knowing "old soldier" type of regimental medical orderly, to pick out the "good

hats " from the "bad hats"! Nevertheless, the average Tommy is a sportsman, even when he is a bad soldier, as the following story, which is well known to many senior officers, will show. A certain R.M.O. who had been a popular guest at a guest night at one of the local regimental messes, arrived ten minutes late for his medical inspection the next morning, and feeling "like the wrath of God." Calling the parade to attention, he addressed them as follows: "If any man on this parade feels as ill as I do let him fall out." (Pause, a few half-stifled sniggers, and no fewer sympathetic grins from the men.) Not a single man fell out! The points I wish to make are, first, that the R.M.O. may have little time for a prolonged examination of a sick man, and that although unit M.I. rooms have improved out of all reckoning in the last fifteen years, such examination as he is able to make may be very incomplete. On the other hand, however, there is no excuse for sending a man to a specialist for opinion, without the fullest possible notes on the history, and on such examinations as have already been carried out. With all due sympathy for the R.M.O., and with the best will in the world to help, it is *not* the duty of the specialist to do such spade work for himself, and what is more he has no time for it unless "business" is very slack. You will soon find out the M.O. who is doing his job, but when he is not doing it he should be firmly told so and the case sent back to him for further investigation, if this can be done without prejudice to the patient's condition.

Regs. M.S.A., para 169, directs that the name of every soldier reporting sick shall be entered on a sick report (A.F.B. 256), which will be prepared *in duplicate*. Para. 170 states that a soldier must bring his medical history sheet (M.H. sheet) with him when sent to hospital. The M.H. sheet is a confidential document and must be sent in charge of a N.C.O. or under cover.

The R.M.O. enters on both sick reports, and as briefly as possible, the history, symptoms, signs, and reason for sending the case to you. If the problem is a simple one it is the matter of a few minutes to scan his M.H. sheet, examine the man, and then, using a carbon paper, type your opinion on the front or the back of the sick report, paste the original into your register on one side of the page, kept blank for such reports, and to return the duplicate and sheet to the N.C.O. in charge of the party. When you realize that the examination will take some time, it is best to examine the patient later, or detain him in hospital for twenty-four hours for this purpose. You write on one copy of the sick report "Case detained 24 hrs. M.H. sheet and report will follow." It is a mistake to waste time over lengthy examinations if there are other cases waiting, and delay often leads to men missing meals in barracks. Again, when you have to prepare a longish considered report, and one which is likely to be helpful in the future, the original should be pasted to the lip of the M.H. sheet on the inside and a note made on the sheet "Special report attached." The copy should be filed in your reports file. Whenever possible give a definite opinion, with your reasons, if required. I owe the following wise remark to an old friend and commanding officer, though I think he claimed for it no originality. "Always treat

another man's diagnosis with respect. But never believe it!" Do you concur in the diagnosis? If so, what do you recommend? Is the man fit or unfit? If unfit; how long do you think he will remain so, and what duties can he be permitted to perform? Should he be invalided? If so, a special report for the medical board will have to be prepared. It is no disgrace to discover in the course of time that your opinion was wrong. Your report can be amended and your error admitted, should subsequent developments discover you in error. I forget who said "that it is better to receive a slight reprimand than to perform an unpleasant duty," but there is no doubt that there will always tend to arise between the Government as employer and the soldier as employee, the question as to whether the employee is "trying it on"—in other words, malingering. The Army always has had and will continue to have its proportion of "swingers." Most can be bowled out and will take their defeat without malice, and even at times with ill-disguised admiration for the M.O. who sends down the ball that gets them. On the other hand, one of the most serious mistakes a M.O. can make is to continue to treat a soldier as a malingerer or as hysterical, without having explored every avenue which might discover him to be in reality suffering from organic disease. Of all symptoms the subjective ones are naturally the most difficult to assess. If a man states that he has constant pain, it is indeed difficult to prove that it does not exist or is imaginary. Under such circumstances, beware! It will be almost impossible to disprove this statement, no matter how much you may doubt it. I think, under these circumstances, it is best to agree and at the same time explain that you can see no reason to believe that his symptom is doing him any physical harm, that there are pains and pains, and that his will probably soon get better. Then give him an innocuous sedative powder to take, and encourage him to carry on, and finally write to the C.O. or adjutant of his unit, and ask for a report on the man. Is he considered a "good" man—a good soldier in his company, and does he play games, etc.? Have they noticed any change in his general bearing or conduct? Such men usually are found among the weaker vessels, or are suffering from a grievance. Some are chronic malcontents. With other cases, disciplinary measures may have to be advised. This in particular for the man who is trying to "work his ticket" (get his discharge from the Army). For this reason certain types of operation, such as those designed to correct deformities of the foot, for instance, which can be readily enough advised and undertaken in civil life, are never undertaken in the Army, unless there is not the slightest doubt in the mind of the surgeon that he has the complete and honest co-operation of his soldier patient. It is almost impossible to disprove that even a clean operation scar is not painful, even though all the evidence is definitely against such a possibility. It is often a question of treating the man as well as his symptoms.

(2) *Minor Surgical Cases.*—These cases include the minor traumatic conditions, and such conditions as varices, hæmorrhoids, and septic infection.

Not so many years have passed since it was the custom (not only in the Army) to treat septic infection when the possibility of pus formation was suspected, by a painful and often brutal "jab" with a knife. The site for the "jab" selected by the operator depended upon his impression on where the pus was most likely to point. Lucky was the patient, who had been able to stick it long enough, to report with an abscess on the point of bursting, so that the "point" was obvious and the increasing tension and necrosis had rendered the overlying skin practically insensitive. Many a man in those days hung back, suffering sleepless nights, rather than consult the M.O. *early*, knowing he had to face the ordeal of a dig with a knife, often without any anæsthetic, or merely a spraying with ethyl chloride, and too often to be told after a bad shot, to "Come back to-morrow and we'll have another go!" Thank Heaven these days are over! It is now universally appreciated that such cases should be treated in a properly equipped theatre, under an anæsthetic. The M.O. who does not now realize that any but a trivial infection of the hand is a major surgical emergency, demanding immediate surgical treatment in hospital, is a danger to a community. Fatalities can be reported in numbers where meddlesome and too-previous incisions for infection were directly responsible. To-day also we have our sulphonamide drugs. I hold that it is part of our mission as surgeons to broadcast the undoubted fact that the art of surgery is not wedded to pain and suffering, and to advertise among the men that it can be divorced from those sickeningly painful methods which brought to it much disrepute before the days of pentothal, nitrous oxide, and local anæsthetics.

The modern M.I. room possesses ample facilities for dealing with certain minor surgical conditions, but I would rather have twenty cases sent up to hospital, there to be dealt with by me or an assistant, than one in which complications had arisen as a result of indifferent or misdirected surgical effort in the M.I. room. It is far better that the R.M.O. should be permitted (he cannot insist) to come up and carry out the treatment of his own minor cases in the operating room. Nothing breeds confidence among the men more than the knowledge that they can come up to hospital, and have a nail avulsed, a cyst or wart removed, or a fracture set, comfortably and painlessly and without having to remain in hospital.

An entry should be made in the M.H. sheet concerning all such minor procedures, and if necessary a separate operation register kept for them. Cases of varix or hæmorrhoids, etc., are best dealt with on a special day in the week set apart for them.

*Fractures.*—Though not necessarily classified as "minor," the conduct of many of these cases comes under this minor heading. On the other hand it is a good policy to see that all serious fracture cases are actually admitted to hospital for a day or two, even if they are ambulant. It is also a good plan to request the Assistant Director of Medical Services (A.D.M.S.) or senior M.O. in the station, to issue orders to the effect that all fracture cases in your area are sent for you to see, no matter how trivial, and that you wish



to accept full responsibility for them. This enables you to see that all details are properly recorded in official medical documents (concerning which I shall have something to say later).

(3) *Follow-up Cases*.—Numbers in this category or group will be fractures. Others will be post-operation convalescents, etc., and men returning from sick leave.

It takes but a second to look up in the out-patient register index, and turn to your last entry. A short note is made on the sick report, including information as to when the case is to be sent to see you next, or simply stating "Fit for duty." The entry has a new serial number in your register, but only the name and diagnosis is written.

In order to illustrate the methods I have advocated, I will quote some imaginary entries.

#### REGISTER OF OUT-PATIENTS. (ALL CATEGORIES.)

1937

(Examples)

Confidential

*Serial*

*No. Date*

(GROUP 1.—CONSULTATION CASES.)

162 2.4.37. Maj. Dasher, P., aged 37. R.A. ? *Renal calculus*.  
History of hæmaturia—intermittent—intervals 3 to 6 mths. for 2½ yrs. Note from M.O. and Civ. Pract. received. Weight steady. 11 st. 6 lb. Urine Ac. 1018 Deposit, Pus. R.B.C. few. No alb. or sugar. Admitted to Hp. for further investigation, Culture urine, X-ray and ? cystoscopy. Note to M.O. (copy attached to documents sent to ward).

163 2.4.37. Jones, J., 304, aged 22. 1/Buffs. *Lacerated medial meniscus knee* (R).  
First injury—June 1935. Football (states organized game). No entry in M.H. sheet. ? A.F.B. 117. Subsequent injuries merely contributory. Unit M.O. to submit fresh form B. 117. Recommend Op. Surgical waiting list. M.H. sheet returned. Temporarily unfit. Fit sedentary duties till admission.

164 2.4.37. Sjt. Jackson, T., aged 30. 1 Buffs. *Brachial neuritis*.  
Report No. 24 37 attached to M.H. sheet herewith. Copy filed.

(GROUP 2.—MINOR SURGICAL EMERGENCIES.)

165 2.4.37. MacTavish, A. L Cpl. 545, aged 20. R. Irish Rifles. *Septic paronychia 2nd finger* (R).  
Nail removed under N<sub>2</sub>O. Entry in M.H. sheet. Attend B for dressing at R.M.I. room.

166 2.4.37. Jessie Bloggs, aged 7. D o Sjt. B., R.A.S.C. *Fracture "green-stick"—Radius* (R).  
X-ray report No. 475. Straightened under N<sub>2</sub>O. Moulded unpadded plaster. Report in 3 weeks. Fingers and hand and shoulder to be used.

167 2.4.37. Smith, W. 442. R.E. *Adenitis neck (cervical glands) ? early supp.*  
Onset 3 days. Mild otitis externa, and seborrhœic dermatitis scalp. To be seen by dermatologist.

## (GROUP 3.—FOLLOW-UP CASES.)

- 168 2.4.37. Jackson (*see* No. 201 of 1938). *Ac. supp. appendicitis* (Op. Nov. 1938).  
Rejoining from leave. Weight 12 st. 1 lb. (gain 12 lb.). Scar firm. No symptoms. Fit. Need not attend further. To light duty 30 days.
- 169 2.4.37 Matthews (*see* No. 45). *Fracture scaphoid carpal (L.)*.  
X-ray (Report No. 259) shows union advancing. Retain plaster splint. Continue convalescent exercise and suitable duties. Report in 3 weeks.
- 170 2.4.37. Twirp (*see* No. 49). *Pes planus and hallux rigidus*.  
No improvement after 30 days' massage and exercises. Unlikely to be fit for duties of an infantryman. Recommend discharge on A.F.B. 204 (Recruits under 6 months' service). (*See* Regs. M.S.A. Appendix II Part 2.) Report attached. (Copy filed.)

A recruit with under six months' service can be discharged on A.F.B. 204—this saves the time taken in carrying out the longer usual procedure, viz. invaliding on A.F.B. 197 (Medical Board Proceedings).

## RECORDS (SURGICAL).

Para. 115, of Regs. M.S.A., directs that the M.O. in charge of the case will make out A.F.I. 1220 (*Hospital Record Card*) for each case on admission and complete it before the patient's discharge. These cards are then sent in batches to the War Office, where they are filed, systematized, and used not only for future reference, but in conjunction with monthly returns for the preparation of the vital statistics of the Army, and the Annual Report on the Health of the Army. The diagnosis should be *printed*, and be strictly in accordance with the terms in the Manual of Nomenclature of Diseases prepared by the combined Colleges. When the case is of routine type, entries need not be extensive. Only relevant history is necessary, and for many conditions "classical signs and symptoms" is sufficient entry under the appropriate heading. Condition on discharge should show the disposal of the case. "Relieved—returned to duty after 14 days' leave (or excused duty) etc."

On the other hand, when the case is more serious, it is governed by para. 116 concerning A.F.I. 1237, namely *Medical Case Sheets*, on which (states the regulation) will be carefully recorded all cases of professional interest, serious illness, and such others as are likely to be required for future reference. The necessity for such a record is obvious. It is the duty of senior officers to see that newly joined officers complete such documents properly and in accordance with the training they received both before and after graduation. When a case is to be transferred, such a sheet should always accompany him; one copy at least should be filed. For surgical cases, the correct place for this is in the surgeon's consulting room. The clerk in the main office

of the hospital notes in the right-hand column of the admission and discharge book that case notes have been received in the main office and that they have been passed to the surgeon's office. Later the file number from this office is added in the admission and discharge book. A reference index is maintained in the surgeon's office in which the patient's particulars and disability are noted. This double-index system permits of easy reference and is better than the rather frequent haphazard system of filing which is occasionally seen in the main office of some hospitals. It is the surgeon who is most likely to require these notes on a future occasion.

#### MEDICAL HISTORY SHEET (A.F.B. 178).

Para. 117 of Regs. M.S.A. instructs the M.O. to "make the necessary entries in the M.H. sheet of each man *admitted to hospital* (the italics are mine) and in doing so will bear in mind the importance of this document both to the individual and the State as a factor determining a soldier's eligibility for a disability pension after his discharge from the Army . . . etc."

Now, except in such cases as are governed by para. 116 when a case sheet must be prepared, or where a copy of a medical board proceedings has been retained, the only official medical documents which can be consulted about a soldier's past medical history are his hospital record card (A.F.I. 1220) and his M.H. sheet. The former of these two is filed at the W.O. (Medical Directorate in India), and by the time it can be procured and consulted, any urgency for the information has usually passed. If the man's M.H. sheet be lost, information on his past history is, for emergency purposes, non-existent. The importance of the M.H. sheet, both to the man and to the State cannot be overestimated, and anyone responsible for losing one also incurs the graver responsibility of having been the possible cause of a deserving case losing a disability pension, or of a non-attributable case getting one. In the Army, this is the one medical document which contains, or should contain, a complete record of the soldier's health from enlistment to discharge or death. It contains his condition on enlistment, noting any minor disabilities, his dental state, whether he has been invalided home from abroad, or has been issued with any surgical appliance such as a truss (rare in these days), spectacles, or an artificial limb. It shows when he received preventive inoculations. In red ink is entered the meritorious fact should he have voluntarily given of his blood.

A retired officer of the Corps, who was engaged on a travelling medical board which, like many others, was concerned in dealing with the enormous number of men who claimed a disability of some sort or other, after the Great War, told me that much difficulty arose because many M.H. sheets were badly written up. He estimated that these omissions resulted in a very considerable financial loss to the State.

I have always maintained that para. 117 of Regs. M.S.A. should be

amended to read "will make the necessary entries . . . of each man *whether admitted to hospital or not.*" Hence the above italics. It has been argued that any soldier suffering from a condition which might conceivably give rise to a permanent disability should be admitted to hospital forthwith and will, in consequence, have a relevant entry made in his M.H. sheet. More of this attitude later. The point is that in a number of cases, while insignificant entries appear in the document because the soldier was admitted to hospital, others with a far-reaching influence on his future health and fitness may be missed, because at the time there was no necessity to admit him. Here is an example. Pte. B. is sent to see you complaining that his wrist is hurting him, and he cannot handle a rifle, a spade, or cricket bat without pain. He looks a good type of man, and states that he has boxed for the regiment. On a superficial examination you discover a "crick" in his wrist. You consult his M.H. sheet, but the only entry refers to a carbuncle for which he was an in-patient for three weeks the previous spring. On further questioning you discover that he fell in the gymnasium eighteen months previously, while training with the regimental boxing team, but did not report at once. Three days after the injury he had to see the M.O., who stated that he was unfit to box, but allowed him to travel as a supporter with the team. In the course of your further examination your suspicions are confirmed by finding an ununited fracture of the scaphoid carpal, with commencing osteo-arthritis. Increasing years will not improve the condition, and union is doubtful. Here then, is the case of a soldier whose M.H. sheet contains an entry concerning a trivial incident in his medical history, while an event with far-reaching consequences remains unrecorded. It is unrecorded because under the regulations an entry was not demanded. If, at the same time, A.F.B.117 (Record of Accidental Injuries) was not rendered, and the man cannot produce actual witnesses to the injury, his statements having no documentary backing, may be discredited and his permanent disability is ruled as "non-attributable." The remedy is to record such injuries in the M.H. sheet, *whether the man be treated in hospital or not*, and to make sure that the injuries form is also submitted. It is *not* necessary that all such cases should be admitted to hospital.

At one time C.O.s were averse to having unfit men hanging about barracks, as they put it, and it was argued that hospital was the only place for any man unfit to carry out full duties. Because a healthy individual happens to fracture his wrist during a game, or at P.T., surely there is no reason to confine him to a hospital ward, when he might be using his legs freely in the fresh air out of doors, wearing a well-fitting plaster splint? Admission would certainly make me, and I believe most of us, "bolshie." Besides, it costs the State considerably more when a man is admitted to hospital, and there would be hospital stoppages to come off his pay. On the other hand, such ambulant temporary unfits must not be allowed to get slack. They should not be expected to turn out on the early morning parade, because washing and dressing take them some time. They can be employed on numerous

suitable jobs, and can be very useful about barracks or in the offices. They should be permitted to take convalescent exercise out of barracks, but their pass should be forfeit at once if they are not smartly turned out, or are guilty of any breach of discipline. No really sick man minds going to hospital, and many improve with the rest alone, but the better soldiers, more particularly now that barrack accommodation has so vastly improved, will try to avoid going to hospital when they might be out in the sun, bathing, or watching their unit play in the cup matches. To shut men up in a ward under certain conditions is wrong and financially unsound. Even the best soldier is liable to become disgruntled and may become unruly in a ward, when he feels he might be out and about. Good soldiers are often the best athletes; they are apt to make the mistake of attempting to carry on without reporting sick after an injury, not only in the hope that the hurt will soon recover, but because they do not want to be sent to hospital. But if it is generally known that the surgeon will treat them in such a way that they can be permitted to remain in barracks and get about, they will not hesitate to report injuries early. It will be appreciated that the fostering of this attitude works to the advantage of both the man and his surgeon.

#### REPORT ON INJURIES (OTHER THAN THOSE RECEIVED IN ACTION). A.F.B.117.

Para. 114, Regs. M.S.A. : " In all cases *admitted* for injuries (the M.O.) will, without delay, complete A.F.B. 117." Para. 48 directs that all " such cases shall be reported to the C.O. of the unit when an officer, nurse or school-mistress *is admitted to hospital* in consequence of having been maimed, mutilated or injured . . . whether on or off duty." The italics are mine.

The object of this form is to see that all such cases shall be investigated at once, when the occurrence is fresh in the minds of all concerned, and especially of witnesses, and that the factor of attributability may be assessed. The M.O. is asked to state the nature of the injury, and its " effect on the future efficiency " of the injured party.

The procedure which the C.O. must take is laid down in King's Regulations. It is not always easy to complete the medical part of this form " at once." On occasion it is a wise thing to enlarge on the usual answer given. Here is an example : A driver engaged in " stables " is kicked on the shin by a mule, and after first-aid treatment, limps to hospital or is carried on a stretcher. With average luck this injury might be considered trivial, but it is not difficult to visualize a very different state of affairs should infection become established, and involve the bone, or lead to septicæmia, jeopardizing the limb or even the man's life. A stab with a stiletto can be trivial in its immediate effect, but a very different state of affairs ensues should the pleura, a joint, or the mediastinum become infected. Should you suspect this sort of possibility it is wise to be guarded in answering para. 2; you must not delay in submitting the form. The answer should be framed on these lines :—

(A.F.B. 117. Answer to Part 2.)

Contused wound, leg (rt.).

Trivial in immediate effect, and unlikely to interfere with future efficiency.

(N.B.—Should septic infection become established and spread, the condition must be regarded as *severe* as it may prove dangerous to limb or life, and the answer given to this question would require amendment.)

The unit C.O. then knows how the land lies and will complete the form accordingly, or take care to see that all the circumstances are investigated. It is as well to enter on the M.H. sheet in the column "Cause of the disability" not only that the "patient *states* that he sustained the injury on duty (while grooming)" but that A.F.B. 117 has been rendered. A note to this effect should also be put somewhere on the hospital record card.

The regulations direct that B.117 is to be completed for "such cases etc. . . . *admitted to hospital* in consequence, etc." I maintain that the form should be rendered in any case when there is reason to anticipate any permanent disability from injury, *whether the case be admitted to hospital or not*. Consider knee injuries, for instance; it is well known that a small tear without separation of a meniscus causes trivial disablement. But once a tear has commenced, subsequent twists are most likely to increase it, and sooner or later the man becomes unfit and will require operation. In a majority of cases the operation renders him fit, but it may not do so. For this reason the first injury, which initiates the disability, is of most importance and should receive careful attention and investigation. Should the original injury occur "on duty" although subsequent twists may have occurred "off duty" any permanent disability must be regarded as "attributable—on duty." Therefore it is very necessary to see that there is made a record of the initiating injury, even though you may not have seen the case till after a subsequent twist. Under the latter circumstances the injury form should be filled in as under.

Sprain, knee (rt.), recurrent, with clinical evidence of internal damage to joint or menisci. Will interfere with future efficiency. Severity will depend upon result of operative interference.

[Note.—In my opinion this condition was initiated by previous injury, probably on . . . (date) . . . on which occasion the patient *states* he was playing in an organized game of football.]

It is then the duty of the O.C. unit to investigate the *primary* injury and decide attributability. So much for out-patients.

(*To be continued.*)

## EPIDEMIC INFLUENZA.<sup>1</sup>

By MAJOR C. H. STUART-HARRIS, M.D., M.R.C.P.,

*Royal Army Medical Corps.*

THOSE of us who have had the opportunity of working upon the subject of influenza during recent years have speculated from time to time upon the possibility of a renewed pandemic of the disease. Now that war has again involved a large proportion of the world's population this possibility has become a matter of great practical importance if it is true, as many believe, that the disastrous pandemic of 1918-19 was in some way related to the world war of 1914-18. Divergent views upon this latter theory exist, but a statement of the present knowledge of the causation of epidemic influenza and of the possibilities of the control of the disease by specific means may be opportune.

### RELATION BETWEEN INFLUENZA VIRUS AND EPIDEMICS OF RESPIRATORY DISEASE.

Since the first isolation of influenza virus in 1933 by Smith, Andrewes and Laidlaw, the findings of these workers have been confirmed by investigators in all parts of the world. The use of the ferret as a test animal for the presence of virus in the throat and nasal secretions during the early stages of the disease has led to the demonstration of the virus in many of the epidemics of influenza which have affected the populations of whole countries since 1933. The virus was not found by Francis (1937) in an epidemic diagnosed as influenza in California in 1935 and it has not been demonstrated in Britain in those localized outbreaks frequently diagnosed as influenza which occur often in public schools and Service establishments chiefly during the winter and spring. At one time it seemed possible that major clinical or epidemiological differences might be discerned between those localized outbreaks which were not associated with influenza virus and those epidemics where the virus was present. This hope appeared brightest in 1937 when many cases of influenza virus infection were seen, and a composite picture of the typical attack was drawn which contrasted with the picture seen in 1936 in the non-virus outbreaks then designated "febrile catarrhs" (Stuart-Harris, Andrewes and Smith, 1938). The acuteness of the onset of illness, the emphasis upon general or constitutional symptoms, and the absence of catarrhal symptoms or signs were held to be characteristic of influenza virus infection. The explosive onset and spread of the outbreak, and the uniformity of clinical picture in those attacked

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<sup>1</sup> Read before the British Medical Society of the Dieppe area on January 13, 1940.

were also thought to be characteristic features of the virus infection. Our recent experience in the early spring of 1939 has discouraged us in that at Hampstead we were unable to detect clinical differences between cases or outbreaks where influenza virus infection was proved and those where the virus seemed to be absent (Stuart-Harris, Smith and Andrewes, 1940). In this year the outbreaks seemed indeed to be a mixture of different infections, the virus being isolated from certain outbreaks but not from others. Furthermore, cases were seen which possessed the same clinical features as the virus-positive cases of 1937. The failure to isolate virus from some of these 1939 cases and the absence in them of serological changes specific for influenza virus infection has made the task of clinical differentiation infinitely more difficult.

However, in 1937 influenza caused an epidemic which spread rapidly from one end of Great Britain to the other and which was associated with a sharp rise to a peak in the figures for pneumonia incidence and death-rate. In 1939 there were many localized outbreaks of respiratory disease but no spreading epidemic. There was also a slow rise in the pneumonia incidence and death-rate, which was sustained without a characteristic peak of any considerable magnitude. This epidemiological difference between the years must be considered side by side with the fact that influenza virus was isolated from the majority of human garglings tested in 1937 but from a minority only in 1939. The year 1933, which was a year with a big influenza epidemic and peak in pneumonia mortality in Great Britain, was also the year when influenza virus was first isolated, and the epidemiological and laboratory findings in 1935 in Britain were closely similar to those of 1939. We may argue from this that although influenza virus infection is not a recognizable disease in the individual case or perhaps in a localized outbreak, yet when it occurs as a spreading epidemic of the type seen in 1937, it partakes of the characters recognized historically as significant of influenza and the epidemic is associated with an abrupt rise in the incidence and mortality rate from pneumonia.

Little can be said regarding the aetiology of the localized outbreaks of "febrile catarrhs" which occur seasonally in schools and Service establishments. In certain years, as in 1939, some of the outbreaks or perhaps a proportion of the cases in one outbreak appear to be cases of influenza-virus infection. The majority are not infected with influenza virus and although most of the cases comprise colds, pharyngitis, tonsillitis, or pharyngo-laryngo-tracheitis, cases will at times be encountered with a syndrome indistinguishable from influenza-virus infection. We do not know the cause of these types of respiratory disease or even if they represent one or a group of diseases. It is clear that we are still only on the fringe of knowledge of the causation of epidemic diseases of the respiratory tract in man. Nevertheless, the ferret-pathogenic virus which we can identify in the laboratory seems to have been associated with nearly all the major epidemics of influenza experienced in various countries since 1933.



The causation of the pandemic type of influenza such as that experienced in 1918-19 remains for the time obscure. The occurrence of three distinct waves of infection, the high incidence of pneumonia in the last two waves, and the shift in mortality towards the younger age-groups were features of the 1918 pandemic, which contrast sharply with the experience during recent epidemics. Because such definite epidemiological differences exist between pandemic and inter-pandemic influenza, differences probably exist between the ætiological agents responsible for the outbreaks. It is possible that in 1918 a strain of virus of exceptional virulence with the power to attack the lung arose spontaneously as the result of exceptional world conditions at the time. On this theory the first wave in June, 1918, was due to the type of virus with which we are now familiar, and the succeeding waves were due to the mutant pneumotropic virus which was aided in its attack in certain localities by a variety of secondary bacteria. Such virus mutations can occur in the laboratory and strains of virus of widely differing pathogenicity have been produced by simple passage from one animal to another. Thus strains of the W.S. virus which was first isolated in 1933 have now been produced which differ from the original virus in that they are highly virulent for the ferret and mouse and cause death from pneumonia. Two mouse strains of the W.S. virus have been produced, one of which is highly lethal when introduced intranasally and the other of which (Stuart-Harris, 1939) kills when introduced directly into the brain without the induction of lung lesions. It is interesting to note that these changes in the pathogenicity of the virus are not accompanied by antigenic variations. It is obvious that changes which occur in the laboratory may be exceptional, but they indicate that this particular virus is not fixed in its behaviour. The fact that the virus can be induced to attack the lung in the laboratory indicates the possibility that it will under natural conditions attack the human lung and the isolation of virus from the lung of rapidly fatal cases of pneumonia was recorded by us in 1938 (Stuart-Harris, Andrewes and Smith, 1938). It has been suggested (Laidlaw, 1935) that swine influenza, which made its first appearance in 1918 in the Middle West of the U.S.A. represents the survival in swine of the causative organism of the human pandemic. The virus of swine influenza is certainly a close cousin of the human virus but differs from it serologically. The natural disease of pigs is due to the combined action of a *Bacterium hæmophilus influenzae suis* and of the virus (Shope, 1931). Shope has suggested (1936) that this bacterial association of swine influenza virus, which is not a property of human influenza virus isolated of recent years, might explain the common occurrence of bacterial invasion in the cases of influenza in 1918, if we assume that swine influenza virus was then a human pathogen. At any rate, nothing is truer than the fact that it is impossible to do more than speculate about influenza epidemics of the past and the causation of pandemic influenza must remain a mystery for the present.

## IMMUNIZATION WITH INFLUENZA VIRUS.

It is not the purpose of this paper to detail the mass of observations which have been made in the laboratory upon the immunization of laboratory animals with preparations of influenza virus. The recent reviews of Andrewes (1938, 1939) should be consulted by those interested in the problem. The studies in this country of Wilson Smith, Andrewes and Laidlaw, and of Fairbrother and Hoyle, of Francis and his associates in the U.S.A., and of Burnet in Australia, have laid a solid foundation of knowledge concerning the behaviour of human influenza virus in the laboratory. The less well-known studies of Shope upon the natural disease of swine—swine influenza—have been hardly less important in their bearing upon the human problem. Thus Shope showed at an early stage of his investigations that the pig disease had a dual ætiology and he then demonstrated (1932) that immunization of pigs with virus alone would protect against subsequent infection with both virus and bacterium. The importance of this finding with regard to the human problem is obvious inasmuch as secondary bacterial invasion was probably responsible for the deaths from influenzal pneumonia in recent epidemics.

Three methods of vaccinating ferrets and mice with human influenza virus have been found to be effective in producing immunity and have been applied on a limited scale in man. Firstly, the inoculation of ferrets and mice with living virus subcutaneously or intraperitoneally will not cause infection unless the virus is given in massive doses, and it will protect the lung from subsequent deliberate infection. It will not, however, protect ferrets against direct intranasal infection although some resistance to contact infection is obtained. The method will reinforce a waning immunity in ferrets who have suffered a previous infection with virus but have become susceptible again owing to the passage of time. Francis and Magill (1936, 1937) showed that living virus cultivated in chick embryo tissue cultures was harmless to man when injected subcutaneously, and that so given it produced an increase in neutralizing antibodies against the virus present in the blood. Stokes *et al.* (1937) have claimed that vaccination of children with living virus cultures caused a reduction in the incidence of febrile respiratory infections during an influenza epidemic subsequent to inoculation. The method has not yet been tried in this country.

Secondly, the intranasal use of virus attenuated by passage upon the chorio-allantoic membranes of developing hens' eggs has been tried. This strain of virus (Burnet, 1937*a*) produces only an inapparent infection in the ferret and has been given to man without harm. It is claimed that a rise of antibodies in the blood follows the intranasal inoculation, but no test of the prophylactic value of the method has yet been obtained. It is clear that the method might be dangerous in that if the attenuated virus was given on a large scale it might regain its virulence and be responsible for the outbreak of an epidemic. On the other hand, this risk would not be

present if the virus was only given during an actual epidemic and it is possible that thus administered it might exert a blocking or interference effect upon natural virus acquired by contact infection, even prior to the development of a true immunity response.

Thirdly, virus which has been inactivated by heat (Fairbrother, 1938), or by formaldehyde (Andrewes and Smith, 1937) will immunize ferrets and mice although less effectively than living virus. When administered subcutaneously in the form of a formalized filtrate of infected mouse-lungs it will produce a substantial rise in circulating antibodies to the virus (Stuart-Harris, Andrewes and Smith, 1938). Two field trials of this method of vaccination have been carried out by us, but a conclusive answer has not been obtained as to its value. The trials have, however, demonstrated to us the extraordinary difficulties which exist in assessing the value of any prophylactic in this disease. The first difficulty is that of judging the time when an epidemic is to be expected. In 1937 the epidemic broke out while vaccinations were actually in progress, but in 1939 the Naval Institution, where inoculation was carried out, did not suffer an outbreak of influenza until four months after the completion of inoculation. The importance of judging the best time to carry out inoculation is due to the fact that serological studies suggest that immunity following subcutaneous vaccination does not reach its peak for at least ten days after the injection and will probably have begun to decline six weeks later. The second difficulty is that of assessing the nature of the infections which develop in the inoculated persons subsequent to vaccination because of the existence of the "febrile catarrhs," streptococcal and other infections which cause influenza-like diseases. In the field trial of 1939 this difficulty was considerable because of the existence of outbreaks of "influenza" which were not due to influenza virus. We did isolate influenza virus during the outbreak at the establishment where vaccination had been carried out, but were unable to arrive at any conclusion as to the proportion of cases infected with influenza virus at the time. In view of the other outbreaks which did not yield influenza virus it seemed probable that only a proportion of the cases in both vaccinated and control subjects were due to influenza virus infection. The third difficulty is that of the manufacture of the virus vaccine and the selection of the strains of virus most likely to produce a good immunological response. Formalized mouse vaccine is certainly more difficult to prepare than living culture vaccine, and it requires a large stock of healthy mice. The need for selection of strains of virus has arisen from the discovery that antigenic differences exist between the various human strains so far isolated (Magill and Francis, 1936; Burnet, 1937b; Smith and Andrewes, 1938). A polyvalent vaccine composed of several different strains of virus may therefore be more effective than a vaccine composed of a single strain. On the other hand, strains of high virulence for the animals used in preparing the vaccine are needed in order that the maximum yield of virus be obtained.

## DISCUSSION.

It is clear that control of epidemic influenza by specific means of immunization is still far from being within our grasp. Yet the generally acknowledged inefficiency of methods of control by the use of masks, gargles, and of quarantine must stimulate renewed attempts upon the problem by other means. Unless our knowledge of the hygiene of air-borne infection is considerably altered in the near future it seems impossible to prevent a disease-spread by droplet infection from infected cases and healthy carriers except by specific immunization. In the case of influenza a method of vaccination is needed which will produce immunity or blocking of infection in the face of a spreading epidemic. The fact that such a method is still not available should probably not deter us from the use of methods which have been on trial but which are still of unproven value. It is doubtful whether the use of specific methods of immunization would be worth while during the next year or so if we are faced with a repetition of the mild type of epidemic experienced in 1937. If, however, we are unfortunately faced with a reappearance of pandemic influenza of the 1918 type, our attitude should probably be different. It must first be established whether the disease is in fact due to a virus of the ferret-pathogenic type, and attempts to isolate virus must therefore be carried out as an essential preliminary step. In order not to wait until the epidemic is in full sway it will be necessary to test any localized outbreaks of a suspicious nature. It is perhaps true that epidemics usually appear without warning, yet if the events of 1914-18 be re-examined, it becomes apparent that respiratory epidemics of a peculiar nature were seen in the years preceding 1918. The disease described by many workers as "purulent bronchitis" (Abrahams, Hallows, Eyre and French, 1917) may have been in some way a precursor to the pandemic. It is certainly true that although sporadic cases resembling this disorder have been seen of recent years, no outbreak of it, so far as the writer is aware, have been reported since 1918. At any rate, it certainly seems advisable for all of us to be on the look-out for respiratory outbreaks of a peculiar nature at the present time. It is clearly not worth while examining the simple catarrhs and nasopharyngeal infections which are always with us, but arrangements should be made for the proper investigation of any outbreaks with an unusually high proportion of chest complications, for the presence of influenza virus.

Supposing the influenza virus is isolated from some possible pandemic are we justified in hoping that some form of immunization with a virus vaccine may be of value? In fact, laboratory work suggests that it is easier to protect the lung from infection than the nose, and therefore a virus vaccine might be of considerable value in lessening the incidence of chest complications, although less potent in preventing mild nasopharyngeal infections. As to the type of vaccine to employ, opinions may differ as to the best type of preparation. The method of subcutaneous immunization with living tissue culture virus vaccine seems to me to be the most practical procedure

to adopt. The fact that repeated doses of virus do not seem to produce any greater increase in antibodies than a single dose (Stuart-Harris, Andrewes and Smith, 1938) is also not to be forgotten. A single dose of vaccine subcutaneously might therefore be of use in areas not affected by the epidemic at the time of the first isolation of virus. In an area already affected by the disease, subcutaneous immunization is probably too slow to be of value, but in this case the intranasal use of attenuated virus might be worth while. There is clearly no risk of starting an epidemic once the latter has broken out, and even if the attenuated virus produced a mild infection, if protection was obtained against lung complications, the inoculation would be justified.

In conclusion, the time for plans to deal with a recurrence of pandemic influenza is not when the disease has broken out but during a quiescent period. It has been shown in the course of investigations upon epidemics in mouse colonies (Greenwood, Hill, Topley and Wilson, 1936), that a change of population has a most provocative effect upon epidemic disease. The great changes which are at present occurring in the life and distribution of the populations of entire countries cannot be without effect upon epidemic disease and it is unlikely that influenza will play a minor role in this connexion.

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## NOTES ON TREATMENT OF THE RHEUMATIC DISEASES IN THE B.E.F.<sup>1</sup>

By MAJOR W. S. C. COPEMAN, M.D., F.R.C.P.,  
*Royal Army Medical Corps.*

THE importance of this group of diseases is being gradually realized in civil life, largely owing to the work of the Empire Rheumatism Council. It was recently found that they constitute 14 per cent of all sickness amongst the insured population of Great Britain (Glover and Coneybeare), and in view of this figure it is surprising that so little attention had previously been given by national and local authorities, on account of the great loss which this must represent.

As regards the B.E.F., it is known that the incidence of these diseases in the peace-time army is fairly high. It is extremely unlikely under active service conditions, which inevitably involve an increase in exposure, and other contributory factors, that this incidence will be lowered. Herringham, writing in the history of the last war on the tremendous wastage of human material and effort from medical causes, stated that more man-power was lost through so-called minor illness, amongst which "rheumatism" takes a very high place, than combined casualties and major sickness. It is the belief of the writer that so far as "rheumatism" is involved such loss is avoidable by comparatively simple means.

### CLASSIFICATION.

The term "rheumatism" may be used to include a fairly large group of diseases, and this is convenient, provided that a basic classification of this group exists and is clearly understood. The classification recommended by the Committee of the Royal College of Physicians in 1936 seems the best, and is as follows :—

- |   |   |
|---|---|
| (1) Acute rheumatism (rheumatic fever)    | (a) Acute   |
|   | (b) Subacute (apyrexial).   |
| (2) Articular rheumatism (arthritis)      | (a) Rheumatoid type (polyarticular ; generally infective origin).   |
|   | (b) Osteo-arthritic (monarticular degenerative or traumatic origin).  |
| (3) Non-articular rheumatism (fibrositis) | This will often take a special name from the site in which it occurs, e.g. lumbago, sciatica, brachial neuritis, torticollis, pleurodynia, etc. |

### INCIDENCE.

It is impossible to state the incidence of this group amongst the forward units, but reports received suggest that it is relatively high, and accounts

<sup>1</sup> Read before the British Medical Society of the Dieppe area on January 13, 1940.

to adopt. The fact that repeated doses of virus do not seem to produce any greater increase in antibodies than a single dose (Stuart-Harris, Andrewes and Smith, 1938) is also not to be forgotten. A single dose of vaccine subcutaneously might therefore be of use in areas not affected by the epidemic at the time of the first isolation of virus. In an area already affected by the disease, subcutaneous immunization is probably too slow to be of value, but in this case the intranasal use of attenuated virus might be worth while. There is clearly no risk of starting an epidemic once the latter has broken out, and even if the attenuated virus produced a mild infection, if protection was obtained against lung complications, the inoculation would be justified.

In conclusion, the time for plans to deal with a recurrence of pandemic influenza is not when the disease has broken out but during a quiescent period. It has been shown in the course of investigations upon epidemics in mouse colonies (Greenwood, Hill, Topley and Wilson, 1936), that a change of population has a most provocative effect upon epidemic disease. The great changes which are at present occurring in the life and distribution of the populations of entire countries cannot be without effect upon epidemic disease and it is unlikely that influenza will play a minor role in this connexion.

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| (3) Non-articular rheumatism (fibrositis) | This will often take a special name from<br>the site in which it occurs, e.g. lumbago,<br>sciatica, brachial neuritis, torticollis,<br>pleurodynia, etc. |

### INCIDENCE.

It is impossible to state the incidence of this group amongst the forward units, but reports received suggest that it is relatively high, and accounts

<sup>1</sup> Read before the British Medical Society of the Dieppe area on January 13, 1940.



for the loss of considerable working time. The number of cases which arrive at the base hospitals can be ascertained, although they are often sent under widely differing diagnoses. An analysis of the total admissions to No. 3 General Hospital during the first four months of the present war shows that 15 per cent fall into the rheumatic category, whilst it accounted for 26 per cent of all admissions in the medical division. Similar figures were reported from No. 2 General Hospital (Majors Rosedale and Underhill).

The first hundred cases examined fell into the following categories, and probably represent a fair cross-section of the rheumatic sufferers in the B.E.F. It is worthy of note that the average age of the whole group was only 29.6 years: Rheumatic fever (acute and subacute), 15 per cent; arthritis of rheumatoid type (polyarticular), 6 per cent, of the osteo-arthritic type 9 per cent; fibrositis of all types, 70 per cent. The osteo-arthritis appeared to be of traumatic origin in most cases, whilst a large proportion of the fibrositis cases were suffering for the first time, and attributed this largely to unaccustomed exposure. In addition, during this period 15 cardiac cases were referred to the rheumatism department for an opinion, and of these six were diagnosed as rheumatic carditis, three were considered to be functional, and in the remaining four cases no cardiac abnormality was detected, but precordial pain was complained of, and was found to be due to small fibrositic nodules in that area, the pain being reproduced by pressure on these, and in one case running down the left arm.

Patients were not infrequently sent up incorrectly diagnosed as rheumatism. Such cases were found to include hyperpiesia, new growth, progressive muscular atrophy, muscle hernia, ruptured muscle fibres, fractured transverse vertebral process, Raynaud's disease, recurrent dislocation of the clavicle, T.B. hip, metatarsalgia, sacro-iliac strain, pleurisy, oxaluria, shingles, and neurosis.

If the figures above be taken as representing a fair picture of the incidence of "rheumatism" in the B.E.F., it follows that there will be at any time 12 to 15 per cent of such cases in every hospital although this may show some seasonal variation. Assuming that there will be several hospitals of this type with the B.E.F., the problem will be to secure adequate treatment for the many patients of this group, nearly all of which should be capable of being returned to duty as the result.

#### TREATMENT.

The treatment of these cases will be determined to some extent by their aetiology. This does not differ, however, from that found in civil hospitals, with the exception that, with the increasing mechanization of the Army, traumatic cases appear to be increasing, whilst exposure and strain are more common than in civil life, and is potent in provoking both first attacks and relapses. The problem of focal sepsis has no added significance from the military point of view, but is of course equally important. The methods of treatment adopted for use in this group of diseases may be tabulated roughly

as follows: Rest and other general measures, medicinal, injections of various types including vaccines, physiotherapy, which is perhaps the most important single group, and manipulation. There are other methods to which this paper does not refer as they are inapplicable in the present circumstances.

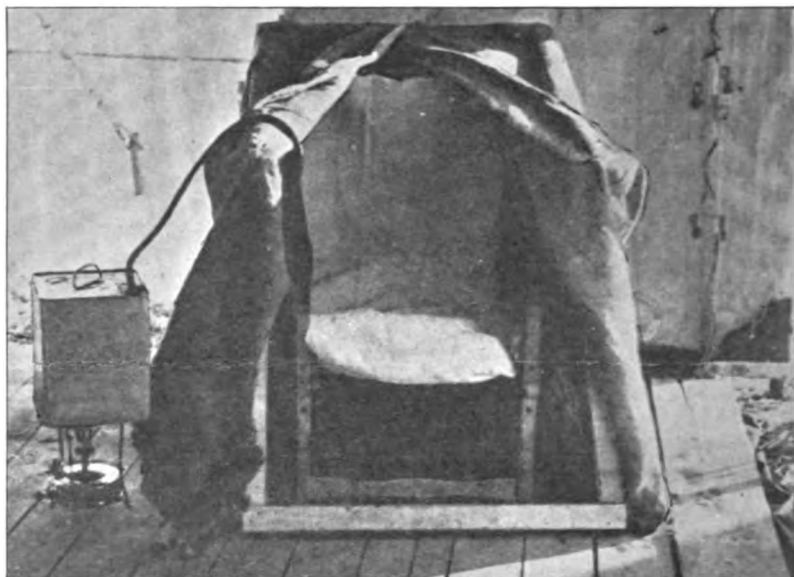
The cases of rheumatic fever must be treated primarily with rest in bed if cardiac symptoms are to be avoided, and since this period of rest needs to be prolonged, they should probably always be evacuated to the United Kingdom once the diagnosis is certain, although a fair proportion of these cases will become again serviceable subsequently.

Most cases of true articular rheumatism (arthritis) of whatever type, will also need more prolonged treatment than is justified in the base hospitals of an expeditionary force, and should also be evacuated to a special centre. There remain, therefore, the group of non-articular cases, which constitute 60 to 70 per cent of the total. These should all prove curable within a reasonable time if adequately treated in an early stage in their complaint. At present they often tend to be rather forgotten amongst their more "interesting" war companions, and it is not uncommon to find that they remain in hospital for considerable periods before being put on to special physical or other treatment such as they almost invariably require for their cure, by which time it may be too late to cure them.

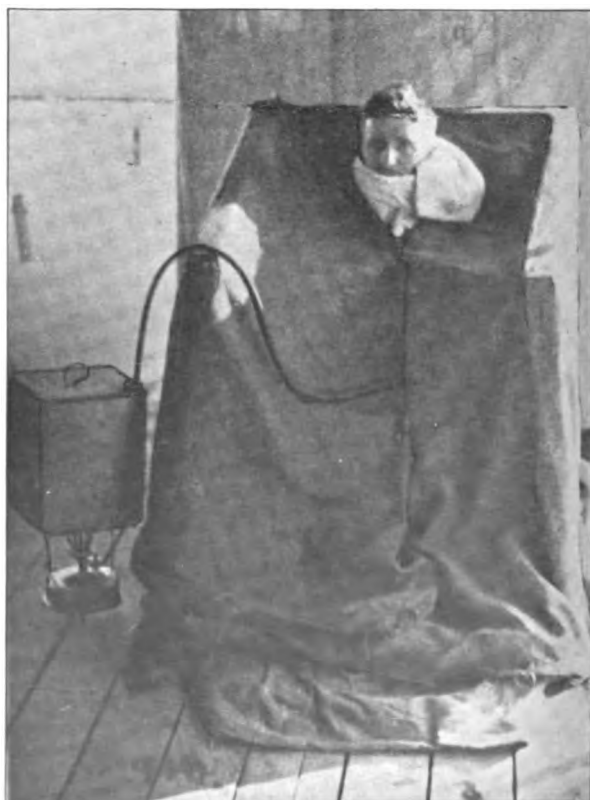
The necessary treatment, although comparatively simple, is not always available, and may need improvising. Broadly speaking these cases, more particularly if they result from exposure, need rest, warmth, purgation, sweating—if possible followed by massage, and for a period a diet low in carbohydrates. The first three items can be provided in any base hospital. An efficient and simple method of inducing sweating is to arrange as a steam bath two towel-rails on three sides of an ordinary canvas chair and cover the whole with several layers of sacking. The patient, wrapped in a blanket or towel, is then sat in this, and steam is led under the sacking through a rubber tube attached to a large kettle or tin which is boiling on a primus stove nearby (fig. 1). Another method which has proved successful is to place two bed-cradles over the patient who is lying on a stretcher or trolley, and to cover these with blankets. The end of a piece of ordinary stove-piping is then led into this "hot-air bath," the other end being placed over the flame of a primus stove or some other source of heat (fig. 2).

Massage is desirable after each method to break down gradually the fibrositic nodules which are the source of the patient's disability. This must be vigorous and progressive, since it is after these have been rendered soft by the heat that the most beneficial effect is likely to be produced.

Where local rather than general heat is indicated, and normal sources such as radiant heat or infra-red ray lamps are not available, improvisation may again be necessary. The illustration (fig. 3) shows a radiant heat lamp which was devised and successfully used at No. 3 General Hospital for several months, during which period electricity was not available. It is

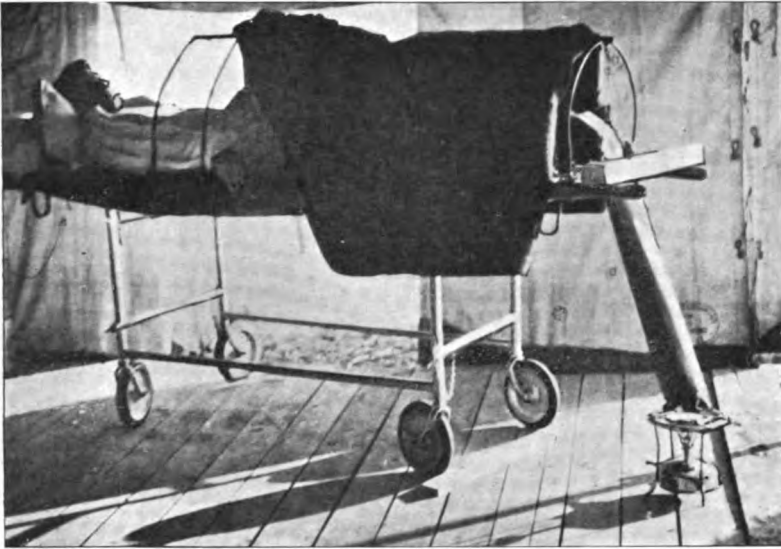


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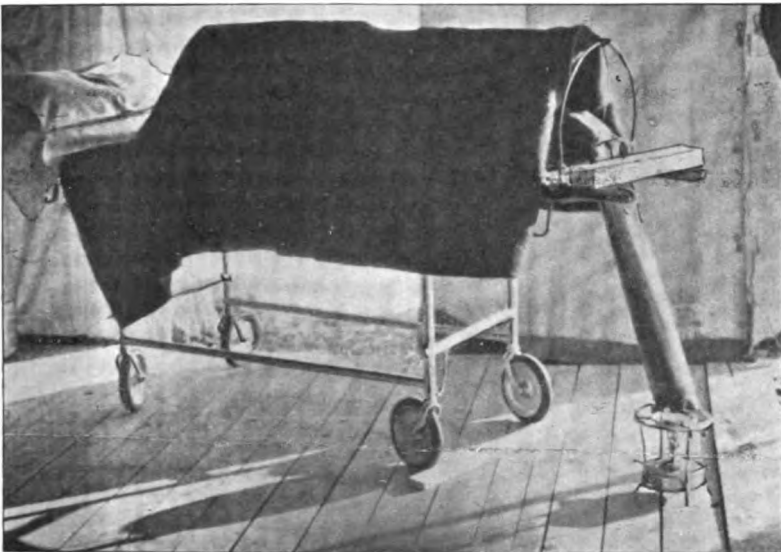


B

FIG. 1.



A



B

FIG. 2.

manufactured from two petrol tins with a further sheet of metal behind to act as a reflector. The source of the heat is a plate of cast iron or a bundle of gas "elements" placed over a primus stove and allowed to glow to a dull

red. In this way infra-red as well as radiant heat rays are produced. Six of these are placed along a six-foot table and the patients sit on a form in front of them and expose the affected part for fifteen to twenty minutes daily. One masseur is able to supervise the treatment of a large number of patients daily whilst himself attending to the necessary massage. In some cases moist heat is found to be more successful than the application of dry heat, and for this purpose the local clay-containing mud was found to be ideal when mixed with olive oil and glycerine to an

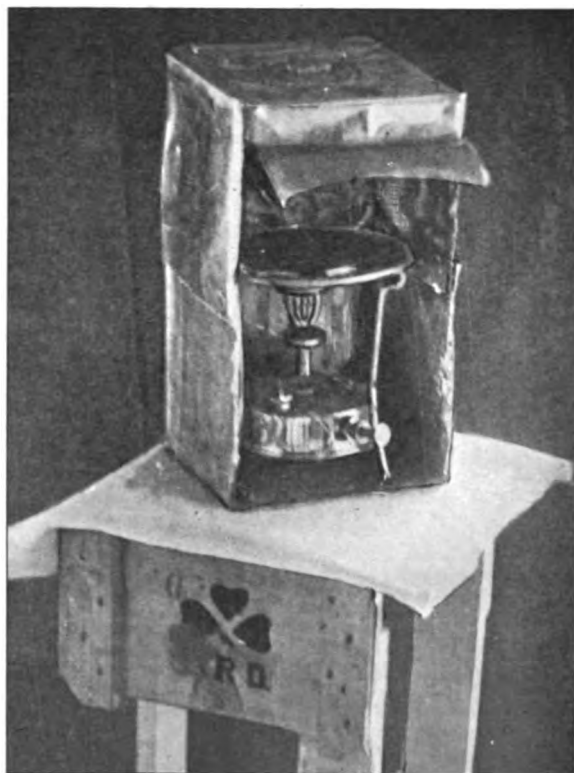


FIG. 3.

even consistency, and was extensively employed as packs. For the treatment of extremities ordinary pails filled with hot, strong brine solution, or sometimes dry salt, or sand, heated to a high temperature, were used successfully, the limbs being immersed in these for a period daily prior to massage and exercises, which the patient was ultimately instructed to practise alone.

Space does not permit of a full consideration of all methods of treatment of the rheumatic diseases available in the field, but certain of these may be considered briefly in addition to the physical methods already discussed.

## MEDICINAL.

Sodium salicylate remains the favourite remedy in cases of both acute and subacute rheumatic fever, although there is no evidence that it has any protective action on the heart. For this reason it can never supersede the necessity for prolonged rest. Aspirin is more successful in controlling the pains of other types of rheumatism—more particularly if they are associated with nasopharyngeal infection, whilst it is generally wise to alternate this with short courses of iodine, in any form. For the articular type of disease sulphur and guaiacol are both worthy of a trial on empirical grounds.

## INJECTIONS.

Vaccine treatment is of necessity a method requiring great accuracy, both in the original investigations and in the control of dosage, if successful results are to be obtained. It requires also considerable periods of time for any results to occur, and for both of these reasons does not appear to be a method which can usefully be employed as a routine in war-time hospitals for the treatment of rheumatism.

Protein shock by means of T.A.B. vaccines or other non-specific agents, aims at stirring up the patient's immunity mechanism—and hoping for the best. Used in non-articular cases which are young and otherwise healthy it is often successful, and as results are quickly obtained where they occur, is a useful method of treatment.

In fibrositis where a definite tender nodule can be isolated in the muscles, an injection of 1–5 c.c. of 0·5 per cent novocain accurately into its centre will destroy it, and will often thus relieve the pain and spasm which may have been affecting a large area as the result of referred pain. Where several such nodules are present each one must be dealt with in similar fashion, and “miraculous” cures of old-standing fibrositic disability may be brought about as the result of sufficient search for the nodules and accuracy in their destruction. This method takes considerable time and is sometimes difficult to achieve, but is of great value.

Histamine acid phosphate (1 mgm. per c.c.) is a substance which has an intensely vaso-dilatory effect and which may be used either for its systemic or its local effect. In the former case the most suitable patients are those who complain of stiffness and paræsthesiæ of the hands and feet—particularly in the mornings. In these cases a subcutaneous injection of 0·1 c.c. on alternate days will often help considerably. It is, however, perhaps more useful still when used as an intracutaneous injection over the site of severe fibrositic pain. The injections should be very small, and several should be made in the same area. In the case of sciatica a dozen or more should be given in the course of the pain. The total dose which should be given is that amount which just causes the face to flush. For this purpose it is best to use 0·1 c.c., and after this wait for a few minutes each time before continuing the injections.

Oxygen injections may be given by attaching an ordinary syringe needle to a rubber tube connected with the cylinder, and inserting the point of the needle to such a depth that it lies below the subcutaneous tissues and above the muscles. At this depth considerable "ballooning" of the skin by the gas will occur, and is desirable. The chief use of these injections is in cases of sciatica, and they are often very successful, although it is generally necessary to repeat them in two or three days if the result is to be permanent. If these are given in the afternoon it is generally advisable to order the patient a sleeping draught for that night, as the gradual extension of the emphysema often tends to produce considerable restlessness a few hours later.

Another method of sciatic injection is to use large quantities of normal saline, with or without 0.25 per cent novocain; in this case, however, the aim is to penetrate the sheath of the nerve, and the injection must be made much deeper. A lumbar puncture needle is best for this type of injection.

#### MANIPULATION.

This method of treatment is most useful in many old-standing fibrositic, and other, cases. This is more particularly so when the back is affected, and when the original onset was due to strain and trauma. Manipulation of this type can be carried out on the patient's bed, provided that fracture boards are substituted for a mattress, and an injection of evipan or pentothal-sodium, with some premedication, gives sufficient relaxation in most cases. The aim of this procedure is to free the small inter- and intramuscular adhesions which occur as the result of progressive fibrosis, and which limit the contractility and extensibility of muscles and other soft tissues such as joint capsules which may become affected. Manipulation must, however, always be followed up immediately and vigorously with movements, and later active exercises, in order that the separated adhesions may not join up again, and to redevelop the muscles which have been freed, since some degree of atrophy due to disuse is likely to have occurred. Where manipulation has proved unsuccessful in a properly selected case, the fault very frequently lies in poor "follow-up" treatment. This is as important as the actual freeing of the affected muscles by the manipulation.

#### COMMENT.

It is suggested in view of the special features of the rheumatic group of diseases that the severer cases might with advantage be centralized at an early stage in one or more hospitals, in the same way that infectious and other cases are at present dealt with. This would allow of the application of special methods of treatment, such as are referred to above, being applied before the case had become a chronic one. Some such method would have the dual advantage of avoiding the necessity to multiply expensive apparatus for physical treatment in every hospital and, what is perhaps of greater importance, it would stimulate a special interest in this type of case, which

does not exist widely to-day, in spite of the high incidence of these diseases. Psychologically the presence of this keenness stimulates the patients themselves to co-operate towards their recovery, and the experience of work in peace-time amongst industrial patients shows that this combination of interest with active treatment where it can be obtained leads to considerably quicker end-results than are otherwise obtained. The majority of the rheumatic cases in No. 3 General Hospital have recently been grouped into a special ward with the permission of Colonel A. L. Foster and Lieutenant-Colonel F. Holmes, and it has been found that in spite of adverse factors and the employment of physiotherapy of primitive design that the grouping of the patients in this way has improved the results obtained.

If a similar plan were to be employed on a larger scale it would probably be necessary to evolve an intensive course of treatment which could be made routine as far as possible for all cases of similar type, and which would be of definite duration.

If patients were referred to such a centre at an early stage three or four weeks' treatment should prove an adequate period. Indeed it is suggested that all cases which had not responded satisfactorily at the end of that period might well go before a standing medical board for further examination, and might subsequently be evacuated to a similar centre elsewhere, where longer term cases could be catered for, including possibly rheumatic fever.

It is suggested that the special treatment of cases of rheumatic disease would prove worth while in view of the fact that it would serve (*a*) to save considerable invalidity ultimately, by sorting out at an early stage those cases likely to become serious or permanent, and (*b*) to get less serious sufferers back to the line more quickly than is usual at present, and without them having developed the "chronic" mentality.

#### SUMMARY.

(1) The importance of the rheumatic diseases as a common source of wastage of man-power is discussed. It is suggested that much of this might be prevented. The incidence and classification of these diseases is dealt with.

(2) Methods of treatment which are available under war-time conditions are briefly described, including methods of improvising some common physiotherapeutic apparatus. Results of treatment.

(3) The suggestion that severe cases of rheumatism occurring in the Army might be centralized for purposes of study and early treatment is discussed.





## Editorial.

### WAR NEPHRITIS.

IN the Great War of 1914-18 very large numbers of the troops engaged in trench warfare suffered from acute nephritis. The disease appeared in the early months of 1915, there being few cases before February of that year, and steadily increased in the following months. In July there were 50 cases per 100,000 troops, and the maximum of a little over 100 per 100,000 was reached in December, 1916. The disease was not necessarily associated with cold weather; it occurred specially amongst men in the trenches, though a few occurred at the base among men who had not been in the trenches. Very few cases occurred among officers, and Dunn and McNee failed to find cases among the civil population in areas where the disease was prevalent amongst the troops.

The disease appeared in the Austrian and German armies about the same time as in the British troops, and presented much the same features. In the French Army the disease appeared later and was not so prevalent; in the Belgian Army the cases were even fewer. There were no cases among the Indian troops although the disease was occurring amongst British troops in the same division. When a division in which cases were occurring shifted its position the incidence remained much the same in the new locality; further a division in which cases were rare did not show any marked increase in taking over an area in which it had been common.

Nephritis does not seem to have attracted much notice in previous wars, except in the American Civil War, when, as in France, it occurred on the establishment of trench warfare and was not confined to the winter months; on the contrary it reached its maximum in the summer months.

The patients in France were young men. When divisions went out to France usually two or three months elapsed before the disease appeared among them. Rose Bradford met with few examples of the disease in men who had been less than a month at the front. The onset was usually rapid with albuminuria, often pyrexia, œdema of the face and so on; dyspnoea was a common symptom and occurred at an earlier stage and was more severe than in civil life. In the great majority of cases the disease was mild and recovery occurred rapidly under hospital conditions. Relapses were not uncommon and some cases passed into the stage of subacute nephritis. Deaths in the early stages were of rare occurrence, but there were a few fatal cases which supplied the facts as to the essential lesion of the kidney.

Shaw, Dunn, and McNee examined the kidneys from thirty-five fatal cases, death occurring in each within a fortnight, the shortest duration

being within forty-eight hours. In cases of short duration the changes in the kidney visible to the naked eye are very slight. Usually the kidneys are of normal size but occasionally some enlargement is present. The capsules are non-adherent and when stripped leave a smooth and usually pale surface. The cortex is generally pale and presents a contrast to the medullary pyramids which are congested. On examination with a hand lens the glomeruli are seen to project from the cut surface as pale translucent globules, this appearance indicating their enlarged and relatively anæmic condition.

While the primary and essential lesion is in the glomerular capillaries, evidence of damage soon appears in the other structure of the kidneys. Such extension of lesion is usually manifest where death has occurred after four weeks and there follow the usual changes found in subacute glomerulonephritis. The kidneys present varying degrees of enlargement, pallor and mottling of the cortex leading to a "large pale kidney." In a proportion of cases a hæmorrhagic condition appears before death and this is likely to occur in various "septic conditions," severe bronchopneumonia, or influenza. The general conclusion is that in the kidneys the primary lesion is in the capillaries of the glomeruli and is characterized by proliferation and swelling of the endothelium; it may be called an intercapillary glomerulitis. Such a lesion is in no way peculiar to trench nephritis; it is recognized as the earliest occurrence in glomerulonephritis. It is met with especially in diseases where streptococci are present. It is to be interpreted as the result of the secretion of toxic substances and not produced by the actual presence of micro-organisms. The kidneys in war nephritis have been carefully searched for bacteria with negative result, as also has been the case in glomerulonephritis in civil life. The lesion is of a general kind, all the glomeruli being affected, though some to a greater degree than others. It is to be noted that the lesions described are those which occur in severe fatal cases. In the ordinary type of case with recovery the lesions must be of slighter degree, and it is conceivable that the condition of the endothelium may pass off and complete restoration to normal result.

There does not appear to be any special feature in the urine of war nephritis as compared with other forms. Albumin is usually abundant. Mackenzie Wallis found the proteins to be the usual serum albumin and serum globulin as in other kidney cases, and he also found the presence of a considerable number of polymorphonuclear leucocytes in the urine to be a marked feature in war nephritis as it is in scarlatinal nephritis. Retention of chlorides is usually distinct in the acute stage and the amount of urea in the urine is diminished in accordance with the nitrogen retention. The amount of urea in the blood may be increased. Mackenzie Wallis found that in acute cases the normal 20-50 mgm. per 100 c.c. of blood rose to 100 or to 150 mgm. According to MacLean and De Wesselow there is generally some retention of urea in early acute cases, whilst in severe cases as much as 600 mgm. of urea per 100 c.c. of blood may be present. A fatal result was

observed in every case when the amount exceeded 300 mgm. They consider the estimation of urea in the blood affords valuable information as to prognosis.

Estimation of the chlorides in the plasma in war nephritis have been made by MacLean and De Wesselow, and by Keith and Thomson. The former found very slight changes in the chlorides of the plasma, while some distinct variations were observed by the latter. Trevan found the chlorides in the blood to be above the normal in four cases examined.

The diastase test has been applied to the urine, and in fifty cases Mackenzie Wallis found marked diminution or absence in thirty-one: eight of these had no diastase in the urine at all. On the other hand those with normal output were all convalescent. He noted that where low values persisted the patients showed a tendency to relapse. MacLean and De Wesselow found that a low diastatic value was associated with nitrogen retention. Patients in the early stage of the disease with a low diastatic value did not as a rule do well. Adler employed the diastase test along with phenylsulphone-phthalein test and found them of great value in prognosis. The two tests were generally in agreement, but sometimes the latter was more helpful, showing the approach of uræmia in the absence of clinical symptoms.

Some œdema is usually present in the early stages, but cases occur without any œdema. Ameuille and Parisot put these latter cases in a separate class which they call pure azotæmic cases. They are more severe and hæmaturia may be present.

MacLean and De Wesselow found that in the early stages all the functions of the kidney are more or less affected: cases occur to which they apply the terms azotæmic and hydræmic. In the former there is nitrogen retention in the blood with a low concentration of urea in the urine and low diastatic value, and there is evidence of involvement of the cardiovascular system. There is no œdema and albuminuria is small in amount. In the latter type œdema is present and there is retention of chlorides and a large amount of protein in the urine. There is no nitrogen retention, the diastatic value is high, and there is no affection of the cardiovascular system.

Acidosis is present in some cases and is closely related to impaired renal function, and appears to depend on the degree of damage to the kidneys. There is no evidence that the marked dyspnœa which has been evident in war nephritis cases, even in the early stage, is due to acidosis.

According to Langdon Brown the blood-pressure is variable, but usually raised, and the most favourable condition is a moderately raised pressure at the outset falling fairly quickly to normal. Most writers agree that the blood-pressure falls as the œdema disappears, and is usually followed by a subnormal value.

All the important results of kidney insufficiency and the associated functional disturbances recognized as occurring in the acute nephritis of civil life have been found to be present in war nephritis.

Lesions in other organs were found by Shaw, Dunn and McNee. In the

lungs a change was often present in the infundibula and small bronchioles. These were dilated and had lost their epithelial lining, their walls were swollen and hyaline-looking, and were covered with material resembling fibrin. In many of the capillaries of the damaged infundibula hyaline thrombi were present. This lesion did not correspond with any usual type of bronchitis and rather resembled that produced by an irritant gas such as chlorine, though the action of gas could be excluded in most instances. The change was comparatively common, being well marked in eight out of twenty-three cases and in a less degree in eight others. If nephritis is due to infection it may indicate the entrance of the infecting agent; in any case it may be related to the dyspnoea which is so marked a feature in the disease. Capillary hæmorrhages were found in two out of twelve cases and were confined to the white matter of the cerebrum. Herxheimer records a case which in the third week of the disease had difficulty in breathing, followed by coma and death. In the roof of the fourth ventricle there were numerous capillary hæmorrhages suggesting some toxic change in the blood-vessels.

The real cause of war nephritis has not been discovered. Exposure to cold and wet might cause the disease, but the established facts do not support the view that exposure is concerned in the origin. The disease is common only in the late winter months and steadily increases through the summer. A similar occurrence was noted in the American Civil War. In other wars, too, there was equal exposure without its occurrence. Langdon Brown obtained a history of exposure in only twenty out of fifty-eight cases, and the experience of most observers with the English and French armies corresponded with this; apart from this there is no evidence that glomerulonephritis can be produced by exposure alone.

There was no evidence that water supply was in any way related to the disease.

Considerable importance has been attached to the food supply. McLeod and Ameuille consider that excess of protein diet, along with deficiency of fresh vegetables brings about a sort of scorbutic or fragile condition of the kidneys with albuminuria, and this passes into a nephritis of mild degree. They found that the excretion of urea by English soldiers was much higher than by the French soldier, and albuminuria was more common in the former; nephritis appeared later and was less severe in the French than in the English armies. It might be admitted that an excess of protein would make the kidneys less resistant to any toxic or infectious condition, but it was pointed out that the officers had as much protein in their diet as the men, and in the later stages of war the proportion of protein in the diet was much diminished.

In connexion with the existence of albuminuria MacLean found a similar frequency in men under training, a little over 5 per cent in 50,000 men examined. It showed no tendency to increase on service or to be followed by injurious effect on the kidneys, and he concluded that war nephritis

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was not due to training but to some cause chiefly operative in the fighting area. Several German writers laid stress on the importance of diet in connexion with war nephritis. Mackenzie Wallis found on examination of the urine no evidence of intestinal toxæmia in war nephritis; there was no increase in the ethereal sulphates as a whole, and indican was not found in more than normal traces. The urobilinuria so often associated with intestinal putrefaction was not observed.

As the war proceeded and cases increased, the theory that war nephritis was due to an infection received more and more support. The examination of catheter specimens of urine has not revealed the common presence of any pathogenic organism. The urine is usually sterile. Blood cultures have also failed to reveal any bacterial growth in war nephritis.

Rose Bradford found that bronchitis was present in 30 per cent of the cases of war nephritis and was the only frequent illness prior to the onset of dropsy. It is possible that the unknown virus may enter by the respiratory passages, and it either tends to cause bronchitis or is aided in gaining a foothold by the presence of bronchitis. This is pure speculation, but the peculiar lesion observed in the infundibula of the lung by Shaw, Dunn and McNee may be of considerable importance in this connexion.

The suggestion that war nephritis is suppressed scarlatina was put forward at a comparatively early period, but for this there was no support: there was no characteristic throat lesion or desquamation. Kayser speaks of the disease as scarlatinoid nephritis and considers it is an independent infective disease probably louse-borne.

On inquiry Shaw, Dunn and McNee could find no evidence of the occurrence of war nephritis among the civil population, though the troops mixed freely with them. Some cases occurred amongst orderlies at the base, and this would suggest that if it is an infection it must be carried in some special manner obtaining among the troops, possibly that it is vermin-borne in a manner analogous to trench fever, but of this there is no definite evidence.

In reviewing the evidence bearing on the ætiology of war nephritis Dr. Robert Muir concludes that two main possibilities emerge. The first is that the disease is the result of concomitant factors—bronchitis or other bacterial infections aided by the diet, exposure, and so on. The second is that it is the result of a specific infection of unknown nature and origin, though possibly a filter-passing virus. It is difficult to regard the first as satisfactory when all the facts regarding war nephritis in relation to nephritis in general are considered. The second would accord better with the definite clinical symptoms, the incidence of the disease, and the early lesions in the kidneys, but cannot be regarded as much more than a probability.

In his article on Nephritis in Diseases of the War, Sir John Rose Bradford pointed out that the number of cases steadily increased throughout the year 1915, the highest incidence occurred in November and December, but the rate was also high in June, July, and August. In 1916 the highest rates were observed in the winter months. The rates were especially high from

December, 1916, to March, 1917, but during this period respiratory diseases were very prevalent, especially bronchitis and lobular pneumonia. Rose Bradford stated that from MacLean's observations it was evident that in the great majority of cases nephritis occurred in men whose urine was known to be free from albumin a short time before the onset of disease, and that it could not be regarded as an exacerbation of a previously existing chronic lesion. Further, the previous existence of albuminuria cannot be regarded as an ætiological factor of importance. Sir John wrote that perhaps the most striking fact in the ætiology of the disease was the immunity of the native Indian troops. Nephritis was practically unknown among these troops in France in 1915; although large numbers of Indian sick in three large hospitals were under his observation he saw no case of the disease amongst them. These troops suffered severely from the hardships of the campaign in 1914-15; more especially from maladies due to exposure to wet and cold, such as bronchitis, lobular pneumonia, and trench foot. Notwithstanding the severity of the respiratory disease, especially bronchitis and pneumonia, nephritis did not occur. This immunity of the native troops is most difficult of explanation, since the only difference between them and British troops, putting aside the question of race, is that their diet and clothing were different, yet there was no evidence to support the view that the disease had a dietetic origin in the British troops. On the other hand the absence of the malady amongst the Indians is undoubtedly an argument against the disease being due to an infection, probable as this is on other grounds; at the present time no satisfactory explanation of the immunity of the Indian troops is available. The case of these troops also throws some doubt on the view that nephritis was the result of some respiratory infection, since, as mentioned above, respiratory affections were prevalent amongst the Indians.

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## Clinical and other Notes.

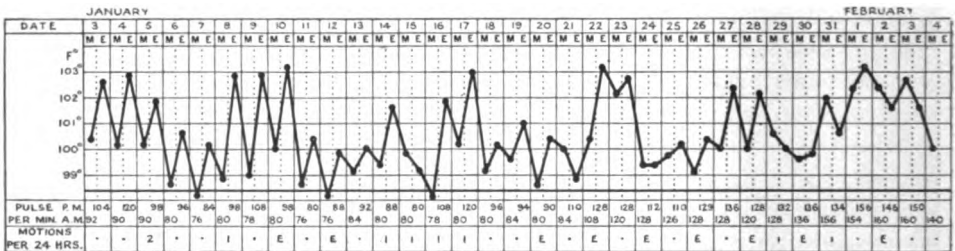
### A CASE FOR DIAGNOSIS.

BY MAJOR G. F. HARRISON,

*Royal Army Medical Corps.*

THE insidious onset, rapid deterioration, and fatal issue of this case, which had so few physical signs and so many negative results of investigations, make it one which I feel is worth recording.

Major X, aged 42, was admitted to the Military Hospital, Hong Kong, on January 3, 1939. I am indebted to Major G. O. F. Alley, R.A.M.C., for details of the case before I saw him on January 18. The patient gave a history of very gradual onset of illness several weeks before admission. There were no definite symptoms. He had, at first, vaguely realized that



he was "not quite up to the mark," and then by Christmas, 1938, he knew beyond doubt that he was ill.

On admission, he complained of pain at the base of the spine and general weakness. There was nothing relevant in his family history. The only previous illness had been amoebic dysentery in October, 1938, for which he appeared to have had very thorough treatment. Between January 3 and 18 he had run an irregular, remittent temperature, and his pulse in relation to the temperature had been slow. Apart from the complaint of pain in the back, and a pronounced constipation there were no outstanding symptoms, and physical signs were limited to the discovery of some septic teeth. Care had been taken to exclude malaria by repeated examination of blood slides, all of which were negative, and the therapeutic effect of atabrin had been tried without noticeable effect. On January 4 the total white cell count was 6,200 per c.mm. Differential count showed: Polymorphonuclears 70 per cent, lymphocytes 20 per cent, large mononuclears 2 per cent. A blood culture on January 9 was sterile after seventy-two hours' incubation. A Widal test on January 10 showed agglutinins in the blood against *B. typhosus*

1 : 1,250, *B. paratyphosus* A 1 : 500, *B. paratyphosus* B 1 : 500, *B. typhosus* "O" 1 : 25, *Br. melitensis* nil, *Br. abortus* nil, Proteus OXK 1 : 25, OX2 and OX19 nil. His stools had been examined several times for pathogenic ova and cysts. None had been seen, nor had any organism of the enteric or dysenteric group been isolated. An X-ray of the lungs on January 12 had shown no abnormality. A further white cell count, the same day, was 7,800 per c.mm. Differential: Polymorphonuclears 57 per cent, lymphocytes 39 per cent, large mononuclears 4 per cent.

When I first saw him on January 18 it was obvious that the general anxiety as to his condition was more than justified. He had steadily deteriorated since admission. For sixteen days he had had a daily rise of temperature, and, in spite of the most painstaking investigation, no clue had been found pointing to the cause of his condition. On examination I found a pale, sweating, hollow-cheeked man, grimly determined to get better. His only complaint was the generalized aches and pains throughout the body, especially marked at the base of the spine. This backache coloured his whole existence at that time. When, subsequently, his backache improved for a few hours he would become quite cheerful; when it was present nothing else mattered to him. What the slightest movement cost him in pain when he shifted his position in bed could be read easily in a face obviously not accustomed to giving way to emotion. This symptom is mentioned rather fully because, together with daily drenching sweats, it constituted almost the only thing of which he ever complained.

His tongue was covered with a thick, foul, grey coat of fur, and this sign persisted in spite of much attention to his mouth. His throat, otherwise, was fairly clean. There was no clinical evidence of anæmia. There were no physical signs in the lungs. An apical systolic murmur conducted a short way into the axilla was the only physical sign in the heart. A very indefinite mass was palpable slightly to the right of the umbilicus, and the percussion note over it was tympanitic. The spleen was not palpable then or at any time later. No physical signs were detected in the central nervous system. His right optic disc (he had lost his left eye in the Great War) was normal. There were no petechiæ in the skin then or at any other time, although a careful search was often made for them. There was no localized area of tenderness in the back on palpation. There was very marked tenderness on light percussion over the lower end of the sternum and also over a small part of the 4th and 5th ribs on the left side, and over the 5th rib on the right side, about two inches outside the nipple line in each case. The affected areas of the ribs were so tender he would not allow them to be touched, however lightly. Scrutiny of the chest (X-ray taken on January 12) did not reveal any sign of new growth or rib destruction.

Having in mind Piney's (1938) assertion that "tenderness on percussion of the sternum, even if the spleen is not enlarged, is almost pathognomonic of leukæmia. Indeed, of the clinical signs of leukæmia, probably the most dependable is such tenderness of the sternum (Mosler's sign)," I sent some

blood slides that day to the Hong Kong University Laboratory for an opinion (the D.A.D. of Pathology being away on duty at the time) and rather too confidently awaited confirmation of the provisional diagnosis of acute leukæmia. However, the differential white count was reported as being: "Polymorphonuclears 67 per cent, large lymphocytes 21 per cent, large mononuclears 9 per cent, small lymphocytes 9 per cent, no abnormal cells seen."

On January 19 his second Widal was *B. typhosus* 1 : 2,500, *B. paratyphosus* A 1 : 1,250, *B. paratyphosus* B 1 : 1,250, *B. typhosus* "O" nil. With a past history of amoebic dysentery, the presence of an irregular fever showing late afternoon rises of temperature, and the drenching sweats, there were grounds for attempting a therapeutic test with emetine hydrochloride, and this was given for four days. This had no effect on either his general condition or temperature, and so the drug was discontinued. On January 20 the blood picture was as follows: Red blood cells 4,720,000, hæmoglobin 98 per cent, colour-index 1.0, white blood cells 11,400. Differential: Polymorphonuclears 72 per cent, lymphocytes 24 per cent, eosinophils 1 per cent, large mononuclears 3 per cent. Drenching sweats continued each day with the irregular fever, but there were no rigors or shivering. From January 22 his pulse-rate began steadily to increase. His appetite, never good whilst in hospital, became distinctly poorer, and general wasting gradually became more obvious. On January 23 urine examination showed nothing abnormal, urine culture was sterile, and there were no agglutinins in the blood against *Br. melitensis* or *Br. abortus*. At times the patient appeared extremely weak, and was indistinct in his speech, and then a few hours later would be quite cheerful and able to converse intelligently. On January 24 a second X-ray of the chest showed no abnormality. The blood sedimentation rate on January 25 was 30 mm. in one hour (Westergren). On January 26 there was noted to be no glandular enlargements anywhere. On January 27 a differential white blood count showed: Polymorphonuclears 76 per cent, lymphocytes 22 per cent, large mononuclears 2 per cent. On January 30 his pulse-rate, which had been steadily increasing, was 136.

On January 31 a mass, about two inches by one and a half inches, was palpable on the left side of the neck just below the angle of the jaw. The mass was smooth, rather hard, and painless. It was not attached to the superficial tissues but was to the deeper structures. A digital rectal examination revealed no abnormality. Two consultants kindly visited the patient and after a careful examination could come to no conclusion in regard to the diagnosis. It should be mentioned that the marked tenderness of the sternum and ribs was constantly present, and that no Bence-Jones protein was ever detected in the urine. On February 2 his blood picture was: Red blood cells 4,270,000, hæmoglobin 72 per cent, colour-index 0.8, white blood cells 13,400. Differential: Polymorphonuclears 50 per cent, lymphocytes 34 per cent, large mononuclears 1 per cent, eosinophils 1 per cent, basophils 2 per cent, Turck cells 2 per cent, myelocytes 9 per cent. A

separate examination performed in the University laboratory showed amongst 500 white cells counted, 30 metamyelocytes and 4 myelocytes. The hæmoglobin percentage of 72 was also confirmed.

His backache had gradually lessened until it was scarcely noticeable, but his general condition steadily deteriorated and by February 3 it was very grave. His pulse-rate had increased to 160. A differential white cell count showed: Polymorphonuclears 34 per cent, lymphocytes 27·8 per cent, large mononuclears 7·3 per cent, transitional cells 4·6 per cent, metamyelocytes 9·3 per cent, myelocytes 13·4 per cent, Turck cells 3·3 per cent, eosinophils 0·3 per cent, 3 normoblasts and 1 megaloblast.

He died on February 4.

*Post-mortem Examination.*—The positive findings were as follows: The mass, a large gland, about three inches by one and a half, was removed from the deeper tissues of the left side of the neck. On section it was firm and white, and in texture was homogeneous except for the presence of a small quantity of thick, white, necrotic-looking fluid in the centre. The 4th and 5th ribs on the left side and the 5th rib on the right, each had one small excavated portion, the width of a sixpenny piece, half filled with semi-fluid, greyish white material. In the thoracic cavity, external to the parietal pleura and running chiefly above and below many of the ribs, there was a series of irregularly spaced, small, greyish-white nodules. Similar nodules were found scattered over the surface of the diaphragm. The heart muscle was pinkish grey, flabby, and thin.

On opening the abdominal cavity, a mass was easily palpable deep to the gut. This proved to be the head of the pancreas which was much enlarged and very hard. On section it was white and homogeneous. The liver, which weighed 4 pounds 15 ounces, was greyish on section and contained no visible deposits. The spleen weighed 17½ ounces, appeared to be enlarged to about twice normal size, was deep red in colour, and contained no visible deposits. The mucous membrane of the stomach was deeply congested. There were no palpable masses in any part of the intestinal canal. There were several white nodules, each about 4 mm. in diameter, in the cortex of each kidney. No abdominal lymph glands were found enlarged.

#### DISCUSSION.

Up to this point in the investigation the diagnosis still remains somewhat obscure, but the number of possible diagnoses is limited to comparatively few. The multiple deposits suggest either a neoplastic process or blood disease, that is to say one of the leukæmias. J. Vaughan (1938) defines leukæmia as a "fatal systemic disease of unknown ætiology characterized by disorderly hyperplasia of the leucopoietic elements of the reticulo-endothelial system. This hyperplasia is manifested by the presence at some time of abnormal white cells in the peripheral blood but not necessarily by a leucocytosis. The diagnosis depends on the nature rather than the number of the circulating cells, in association with certain clinical signs."

While it is true that immature cells need not necessarily be present in the earlier weeks, all authorities consulted mention the severe anæmia which occurs in acute leukæmia, yet this was not present in this case. Nor were there any petechial hæmorrhages in the skin and mucous membranes, or affection of the mouth or gums which so often occur in acute leukæmias. Ewing (1928) says that the lesions of leukæmia, both myelocytic and lymphocytic, involve the bone-marrow, lymph nodes, spleen, and other existing lymphoid tissue, while heterotopic growths of lymphoid tissue appear in the liver, kidney, lung, skin, serous membranes, and many other organs. The picture is that of a diffuse systemic involvement of blood-forming organs and secondary invasion of other tissues. In the bone-marrow the new tissue is firm, light coloured, opaque, or pyoid, but a distinctly aggressive quality as in true tumours is missing. The splenic lesions show a diffuse enlargement, a smooth opaque surface and section, areas of infarction and necrosis, but seldom any localized tumour growth.

J. Vaughan refers to the fact that there is evidence from both histological and experimental studies that leukæmia is a neoplastic process, and some cases of leukæmia are histologically extremely difficult, if not impossible, to distinguish from lymphosarcoma. "There are many cases of leukæmia, especially of the acute type, in which differential diagnosis is impossible."

In regard to lymphosarcoma, reference was made to Ewing (1928), who says that fever is often a prominent symptom, but anæmia and cachexia may not appear until toward the end of the disease. Leucocytosis is usually present and may be so marked as to suggest leukæmia. "In fact," he says, "the distinction between lymphosarcoma and leukæmia cannot always be sharply drawn." He gives the duration of the disease as being from six weeks (very rare) to over three months, and mentions that the kidney is a favourite seat of metastases.

Before considering the possibility that the multiple deposits in the present case were secondary deposits of another type of new growth, it is necessary to postulate the presence of a primary neoplasm, and yet nowhere except possibly the pancreas was a primary growth discovered. With regard to the finding of a very hard, enlarged pancreas in this case, Ewing states that very few satisfactory reports of pancreatic sarcoma are available, and he quotes an isolated report of one diffuse tumour growth in the pancreas with extensive visceral metastases, in which the cells were embryonal and of quite uncertain origin.

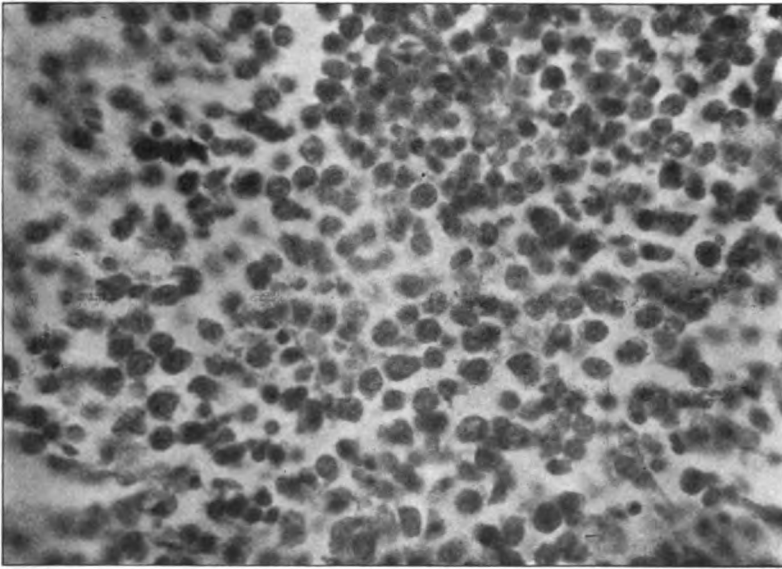
In conclusion, having also considered the various possibilities in the numerous related diseases, not mentioned in this paper, one is forced to leave the diagnosis at this stage on a broad basis, and suggest that it lies between one of the reticulosés, which group includes the leukæmias, and one of the reticulo-sarcomata, which very confusing group includes multiple myelomatosis, solitary myeloma, and lymphosarcoma, no one of which appears quite to fit the picture presented by this case.

## PATHOLOGICAL REPORT.

BY MAJOR G. T. L. ARCHER,  
*Royal Army Medical Corps.*

**SMEARS.**—Smears were made of the creamy material obtained from the cervical gland, ribs, and pleura. On examination they all showed cells in an advanced stage of degeneration, the nuclei were very large, and in many, nucleoli were apparent. These nuclei resembled those of primitive leucocytes.

**SECTIONS.**—*Lymph Glands* (the cervical gland and one small retroperitoneal gland).—Both showed a loss of normal structure, the lymphocytes



Glands.

being replaced by larger cells with vesicular nuclei, resembling reticulum cells. Active mitosis was observed.

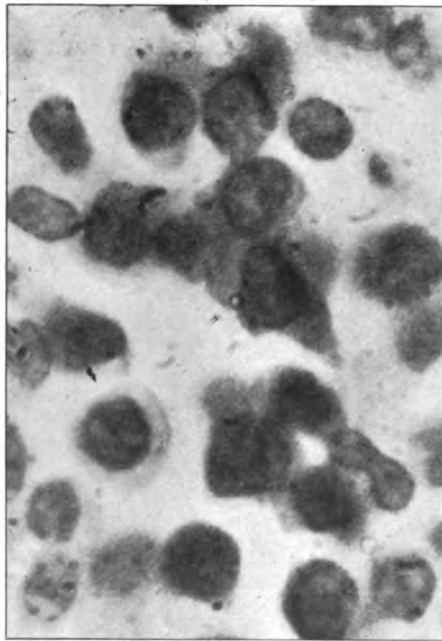
**Kidney.**—There was sharp demarcation between areas of normal kidney tissue and areas heavily infiltrated with round cells. In the areas affected, infiltration, for the most part, was not accompanied by atrophy of the tubules or glomeruli. The infiltrating cells were similar to those observed in the sections of the lymph glands and were almost uniform in size and shape; active mitosis was not observed.

**Pancreas** (head and tail).—In this organ infiltration was much more diffuse, especially in the head, and was accompanied by atrophy of the glandular tissue and some connective tissue reaction. A focus of necrosis, the result apparently of infarction, was observed in a section of the tail,

where, however, infiltration was less intense, an area of almost normal gland being seen. No mitoses were apparent.

*Liver.*—There was only very slight round-cell infiltration of the connective tissue.

The differential diagnosis has already been discussed above. From the pathological point of view it seems most likely that the case was one of aleukæmic myelocytic leukæmia. As against lymphosarcoma there are (1) the apparent absence of a primary growth, and (2) the uniform size and shape of the infiltrating cells. Although macroscopically a primary growth in the head of the pancreas was a possibility it is an unlikely site for



High magnification showing typical cells.

such a tumour, and the presence throughout the section of vestiges of normal tissue would appear to indicate that this organ was a site of infiltration rather than that of a primary tumour. Ewing says: "In myelocytic leukæmia the cells resemble those of lymphosarcoma but are more evenly distributed, less atypical, and the processes less aggressive." This seems to support the diagnosis of leukæmia in this case.

On the other hand the absence of a leukæmic blood count appears to support the diagnosis of lymphosarcoma, but it will be observed that although the total count was never such as to suggest leukæmia, the differential counts revealed a terminal increase in the number of primitive cells.

*Multiple myeloma*, suggested by the bone pain and rib involvement,

is rendered less likely by the infiltration of distant viscera and the predominant type of cell.

The accompanying plate shows photomicrographs of the glands.

We are greatly indebted to Professor L. T. Ride, M.D., of the University of Hong Kong, and to Private J. W. J. Turvey, R.A.M.C., for their kindness in taking the photomicrographs, and to Colonel J. T. Simson, A.D.M.S., China Command, for permission to forward this account for publication.

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### VTH C.C.S. MEDICAL SOCIETY, SECOND MEETING.

HELD AT THE VTH C.C.S., ON DECEMBER 31, 1939.

THE President and twenty members were present. The minutes of the last meeting were read and passed.

It was arranged that the next meeting should be held on Sunday, January 14, at 164th Field Ambulance at 14.30 hours.

Lieutenant Greenfield, R.A.M.C., O.C. 7th Field Hygiene Section, accepted an invitation to open a discussion on Field Hygiene on January 14.

Captain Molyneux, R.A.M.C., of 164th Field Ambulance, agreed to ask a member of his field ambulance to read a paper at the next meeting on January 14; the subject of the paper would be given later.

Major L. O'Shaughnessy, F.R.C.S., read a short paper on the Modern Surgical Treatment of Chest Diseases, and Major G. R. McNab, F.R.C.P. Edin., read a short paper on the subject of Bronchoscopy and Bronchography in Relation to Diagnosis and Prophylaxis and Treatment.

A demonstration was given of special surgical equipment used in surgery of the chest, and a demonstration was also given of various types of pneumothorax and apparatus used by physicians in treating diseases of the chest.

Major L. O'Shaughnessy described the surgical treatment of pulmonary tuberculosis. He explained the principles of various collapse operations. The speaker pointed out the general importance of these operations which opened up the wider field of thoracic surgery. Collapse operations may usually be performed under local or regional anæsthesia, but operations in the cavity of the chest demand a general anæsthesia given in some form of differential pressure apparatus. For gunshot wounds of the chest a wide exposure is essential, and this is most easily obtained by a long intercostal incision.

After removal of foreign bodies, excision of damaged tissues, and control of hæmorrhage from the heart or larger vessels, the chest must be closed with



the lung fully inflated along the line of the original incision and a large tube inserted through a separate stab incision and led into a jug of water.

The speaker then mentioned the various operations including cardio-mentopexy, devised for the relief of cardiac ischæmia, and suggested that the general principles of revascularization would be important in the reconstructive surgery of war.

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## Echoes of the Past.

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### TWENTY YEARS AFTER.

BY H. SKIPTON STACY, M.D., Ch.M.(Syd.), F.R.A.C.S.

*Honorary Consulting Surgeon at Sydney Hospital, Ryde Hospital, and Royal South Sydney Hospital.*

*(Continued from p. 239.)*

#### IV.—GUNSHOT WOUNDS OF THE LIMBS.

##### CASE 1.—Wound of the Thigh with Injury to Popliteal Vessels.

*Clinical History.*—Nature of wounds : Multiple shrapnel wounds.

Signs and symptoms : Left leg : Wound of the heel with a piece of shrapnel in the os calcis. Wound of lower third of the thigh on the inner side, with oblique fracture of the femur and three small pieces of shrapnel in the vicinity. Right leg : Wound just below the patella leading to shrapnel in the inner femoral condyle; another piece just lateral to the same condyle, which had been furrowed on its lateral aspect by the missile. Next day was feeling well, but the left foot was mottled and bluish, circulation stagnant. Heel wound was smelling. Some gauze which had been plugged into the bone was removed. There were several bright red spots on the anterior aspect of the leg, which was slightly shiny and tense, especially in the anterior tibial compartment. It was evident from the condition of the foot that the femoral vein was blocked. (The foot was still warm, so was the leg.) As to the cause of the leg condition, there was a doubt whether it was not inflammatory (possibly from the septic wound of the heel, or from the small multiple skin wounds on the leg).

Operation : Under ether, with the aid of the radiographs, the shrapnel was removed from the condyle, the knee-joint being full of blood ; failed to find the piece on the lateral aspect. The wounds on the left thigh were enlarged, and a Carrel's tube passed through in front of the bone ; a Carrel's tube was also passed down the enlarged inner wound to the site of the fracture, where there was much blood-clot and contusion of muscles. Heel wound opened, but foreign body not found. Put on a Thomas' splint. Next evening, under ether, the thigh wounds were explored ; there was a

sloughy grey appearance of the wound in the muscle around the inner tube ; ? due to the pressure of the tube or ? gas infection of the muscle. As there was pus welling up from the depth of the wound, and the popliteal artery or vein had been injured, making it likely that the whole leg would become gangrenous, amputation was performed through the thigh ; the sciatic nerve was infiltrated with eucaine 2 per cent beforehand.

**Survival :** The patient died shortly after.

*Post-mortem Result.*—**Limbs :** The amputated limb (comprising lower half of left thigh and left leg) was examined. The muscles cut through and those around the tube track were perfectly healthy, the sepsis was purely local around the tube. The femur had been stripped of its periosteum, and the surrounding muscles were much pulped by the trauma. The popliteal artery was cut clean across, a thrombus occupying the cut end of the upper portion ; the popliteal vein was distended and firmly thrombosed ; this condition persisted down the two posterior tibial venæ comites as far as they were traced. A small piece of shrapnel was discovered lying alongside the popliteal vein ; it would have been very difficult to find. Another piece was found on the medullary surface of the bone. The leg was incised over the anterior tibial compartment ; the superficial fascia was slightly œdematous, but the muscles were perfectly healthy. **Left heel :** The sepsis was purely local ; the wound smelled ; a piece of shrapnel in the os calcis, not very deep.

**Comments :** Every smelly wound is not due to gas infection ; the smell of gangrene due to vessel wounds is not to be distinguished from the other ; both are redolent of the post-mortem room. The lividity (which did not disappear on pressure) of the foot was due to the venous thrombosis and the arterial wound. What caused the bright red spots here and there on the leg ? I am not sure ; after the leg was removed they were not obvious. From the point of view of infection there was no need to take off the leg, but it appeared as if it would slowly become gangrenous from the vessel injury, judging from the foot ; and as the foreign bodies had not been removed from the thigh these wounds would have continued to suppurate with almost a certainty of secondary hæmorrhage. It was the fear of secondary hæmorrhage and prolonged suppuration that influenced the decision to amputate, but it was never expected that he would succumb to the shock ; but the operation with its accompanying exploration was unduly long in the performance.

In the anxious endeavour to do everything for this patient he was seen very frequently. Judgment often better with fewer visits.

### CASE 3.—Shock from Multiple Wounds.

*Clinical History.*—**Nature of wound :** Multiple wounds over the legs with much laceration of the thighs and of the hips. Left iliac bone was fractured ; slight retroperitoneal hæmorrhage.

Survival: Died shortly after admission. (Presumably shock ; ? hæmorrhage.)

*Post-mortem Result.*—Chest: Lungs normal. Heart: Right ventricle and left auricle collapsed and empty.

Abdomen: No intraperitoneal trouble.

Limbs: Multiple wounds.

Comments: Cause of death, shock.

CASE 14.—Wound of Femoral Vessels. Hæmorrhage.

*Clinical History.*—Nature of wound: Gunshot wound, thigh. (Aerial torpedo.)

Signs and symptoms: Very pale, much shocked. Perforating wound through the right thigh about the apex of Scarpa's triangle; punctured wound of superficial femoral artery; complete tear of femoral vein (the two ends being one inch apart); wound of profunda artery.

Operation: Bleeding stopped under a general anæsthetic, during which he became very bad. Died a few hours later of shock and hæmorrhage.

Survival: Several hours.

*Post-mortem Result.*—Limbs: The exact information given above was only ascertained at the autopsy.

CASE 19.—Wound of Posterior Tibial Vessels with Infection.

*Clinical History.*—Nature of wound: Gunshot wound, knee-joint.

Signs and symptoms: Has a through-and-through wound just below the left knee-joint behind the tibia and fibula; through the outer wound some herniated muscle is protruding, distinctly offensive. On admission he was very pale and collapsed; left leg cold from the level of the wound down, moderately swollen. Right leg had several wounds, one in the lower third of the thigh, and another in the upper third of the leg. Has a wound also on the right side of the thorax. Next day still very pale, pulse 140, temperature 102·6° F., breathing not distressed; abdomen normal. No hæmoptysis. Left leg is still swollen; skin pale, no mottling; partial anæsthesia in the upper part, complete in the lower part; foot quite cold, but above the ankle the leg was moderately warm. Right leg not swollen or discoloured. The day after operation temperature 101·6° F., pulse 140. For the next five days he lingered on, with his temperature between 97° and 99° F., and pulse about 120; intensely pale throughout. Delirious the last few nights.

Operation: Under ether, owing to the offensive smell of the muscle, it was decided that there was gas infection, and amputation through the lower third of the left thigh (circular and without flaps) was performed. All the muscles cut through were perfectly healthy, although the superficial fascia on the inner aspect of the thigh was œdematous and slightly discoloured. Wounds of the right leg excised; no search made for foreign body. Given pituitrin and intravenous saline at the conclusion of the operation, but he

was very bad. Examination of the amputated limb showed a lot of blood-clot and fresh fluid blood in the track of the wound. It also showed both posterior tibial artery and vein to have been wounded; portion of the artery was shot away, and there was a small wound of the vein. The nerves were also injured. It was doubtful whether the anterior tibial vessels were injured or not. The muscle near the wound of exit was mushy, non-contractile and smelly; the blood-clot around it was also offensive. But apart from this the muscles looked healthy, except in the lower two-thirds of the leg where they were paler than normal (evidently the result of the vascular injuries).

Survival: Seven days.

*Post-mortem Result.*—Limbs: The muscles of the left thigh stump were offensive and brownish black on the surface; also to the depth of a quarter of an inch: the adductors were obviously infected for two inches up, then a sudden line of demarcation; above this the muscle was quite healthy. No crepitation or sign of gas, either superficial or deep. The superficial fascia was healthy looking. Right leg: The remains of the anterior tibial muscles (except the peroneus tertius) were pale and unhealthy looking; the whole exposed surface of any structures that were left in the anterior tibial compartment, were smelly, brownish black and necrotic; the peroneal and calf muscles were perfectly healthy. The right thigh was quite normal.

Bacteriological Report: Aerobic culture of the muscle around the wound: *Staphylococcus albus*. Anaerobic culture showed an organism of the *Bacillus putrificus* type.

Comments: Possibly gas infection of the right leg; possibly the necrosis of the muscles, etc., of the right leg was due to the vascular injuries, together with infection by putrefactive and other organisms.

CASE 22.—Gas Gangrene of Thigh and Leg. ? Septicæmia.

*Clinical History.*—Nature of wound: Gunshot wound, limbs. (Bomb.)

Signs and symptoms: Bomb wound in a raid; two foreign bodies in the lower third of the right thigh; another in the right leg; several other wounds in the left thigh and leg. General condition, good. Temperature 98° F., pulse 100. Next day felt well, temperature 100·6° F., pulse 124. Following day, not so well. Temperature 100·4° F., pulse very feeble, 136; is delirious at times; no vomiting. Right foot was mottled and numb; whole leg was swollen, and the skin is discoloured a reddish brown up to half-way up the thigh; no emphysema. The left foot is also slightly mottled. Died that day.

X-ray Report: X-rays of the right foot and leg showed distinct dark spaces (due to gas infection) in the deeper tissues; these are visible up to just below the knee-joint; above the knee, there is a track of dark space leading up to the foreign body on the inner side of the femur but no gas spaces evident elsewhere. Left leg not X-rayed.

Operation: Wounds were already exuding pus (about twenty hours

after wounding). The pus was thin and yellow with a few gas bubbles. Wounds opened up, Carrel's tubes with gauze inserted; foreign bodies not removed. Two days later was operated on again under ether; he was given pituitrin and one and a half pints of intravenous saline, causing great temporary improvement in the pulse. The right thigh was amputated about the junction of the upper third; it was attempted a little lower but there was much pus in the superficial fascia there. The sciatic nerve was infiltrated with novocain before section. Died several hours later.

Examination of amputated thigh: Showed coffee-coloured discoloration of the superficial fascia of the right thigh; the deep muscles were also infected as evidenced by gas bubbles and slight loss of tone, but the level of infection was about two inches below that of the superficial fascia; there were also small gas bubbles in the femoral sheath, and on opening the vein there were small gas bubbles mixed with the blood; the level of the gas bubbles in the sheath was also about two inches lower than the infection under the skin. The muscles below the knees were discoloured and soft, and exuded many gas bubbles on section. The left leg (examined within half an hour of death) showed coffee-coloured discoloration of the superficial tissues of the leg, with pus along, and at the bottom of, the several wounds; spreading up along muscle planes into the thigh.

Bacteriological examination: Films of pus from the left leg showed streptococci in very large numbers. Films from the right thigh and leg showed streptococci in very large numbers with large Gram-positive bacilli (morphologically *Bacillus aerogenes capsulatus*) in small numbers. Film from the blood of a vein in the arm; no organism seen. In spite of this death was thought to be due to septicæmia.

Comments: X-rays can only be relied upon to show coarse gas infection; fine bubbles are not evident. Superficial gas infection may not always show emphysema. Foreign bodies should be removed if possible, and the wound should be laid well open. Although there was no vomiting in this case, the feeble pulse was a warning.

The wounds had the odour of the post-mortem room.

(To be continued.)

## Current Literature.

ITALY. Law of the 6th June, 1939, introducing compulsory vaccination against diphtheria.

Compulsory anti-diphtheritic vaccination is introduced throughout Italy for all children between the ages of 2 and 10 years. It will usually be performed at the same time as anti-smallpox vaccination and this latter procedure is deferred until the 2nd year of age. All children now attending school, as well as future entrants, must present a certificate of vaccination against diphtheria.

NEVILLE M. GOODMAN.

Reprinted from "Bulletin of Hygiene," Vol. 15, No. 2.

**GERMANY. Circular of the 20th March, 1939, of the Air Minister, concerning the abuse of alcohol and nicotine.**

"One of the noblest duties of a soldier is to preserve and improve his health by every possible means. There is, therefore, a special obligation upon him to be most abstinent in the consumption of alcohol and nicotine." "Drunkenness is no longer to be considered a sign of manliness." Alcohol causes serious harm to the human organism, especially during growth and, moreover, the records of courts-martial are full of examples of crimes that would not have been committed had the accused been sober.

Excessive consumption of nicotine is also toxic for the juvenile organism.

"The struggle against the consumption of alcohol and nicotine is an honourable duty of every soldier for reasons of national policy: excessive consumption of these poisons will in the end sap the forces of the race and, in addition, in restricting consumption more funds will be made available for the acquisition of more important products."

Field-Marshal Goering does not wish to suppress all consumption of alcohol and nicotine, but he lays down that, as far as the German Air Force is concerned, it is forbidden: to instal special bars for the consumption of alcohol in the messes of officers, N.C.O.s. or men; to serve drink to soldiers who have already had some; to take alcohol immediately before going on duty, especially flying or driving; to sell foreign wines in canteens; to smoke in public; to smoke on the march, or during halts or, indeed, on any kind of duty; to sell foreign tobacco in canteens; to keep open canteens and messes after the local closing hours.

Any excessive consumption of alcohol or nicotine must be severely repressed by commanding officers.

*Reprinted from "Bulletin of Hygiene," Vol. 15, No. 2.*

**KARSHAN, M. Factors in Saliva correlated with Dental Caries.**  
*J. Dental Res.* 1939, v. 18, 395-407.

This report is a continuation of one already given by the author and others on the results of an investigation on stimulated saliva in a series of cases of caries-free and caries-active subjects. In the present report the caries-free subjects had full sets of teeth free from cavities or fillings. The examination of the mouths was carried out with minuteness as well as by careful radiograph. The active caries group was chosen from subjects showing recent cavities, enamel lesions, and softened dentine. Another group—arrested caries—showed occlusal cavities with small fillings. A miscellaneous group was added consisting of mouths with cavities or fillings. The ages were 10-41 years, of which 90 per cent were between 15-25 years. The saliva was collected at from one to three hours after breakfast in two portions, 15 c.c., for determination of calcium, inorganic phosphate, and protein; tribasic calcium phosphate being used to remove traces of these by shaking—mercuric chloride (0.05 c.c. in a 2 per cent solution) was added

to the second portion during collection to prevent changes in  $\text{CO}_2$  capacity. The similarity between the caries-free and arrested caries groups in the higher mean values for  $\text{CO}_2$  capacity is shown in the tables as contrasted with those for the active caries group. Carbon dioxide capacity in the saliva indicates the ability of the saliva to neutralize acid—therefore these figures confirm the hypothesis that acid action plays a part in the production of decalcification of the enamel in active caries, and the striking similarity of the figures with those in the arrested caries groups is an added proof. At the same time it is a direct contradiction of an elaborate essay printed by the old Odontological Society three-quarters of a century ago, proving that carbon dioxide was a direct cause of dental caries.

Again there was a lower mean value in the percentage of phosphorus removed in the caries-free than in the caries-active group.

The conclusion from these investigations is on the same lines as that in the recent paper by Gottlieb (*British Dental Journal*), that there is some protective quality to be found in the saliva of caries-immunes which is absent from that secretion in caries-susceptibles. In this report by Karshan there is the statement that in places bathed by saliva and accessible to it there is no caries, whereas in more secluded places there is something which impedes this protective activity—Gottlieb calls it proteolysis, whereas Karshan seeks for it in the “acid neutralizing substances, and by the concentrations of calcium and inorganic phosphate or in forms in which they exist.” In plain English—those mouths free from caries are protected by some quality in their saliva which is absent from the saliva in mouths with active caries.

L. LINDSAY.

*Reprinted from “Bulletin of Hygiene,” Vol. 15, No. 2.*

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## Reviews.

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A HISTORY OF TROPICAL MEDICINE. In two volumes. By H. Harold Scott, C.M.G., M.D., F.R.C.P., D.P.H., D.T.M.&H.Camb., F.R.S.E. London: Edward Arnold and Co. 1939. Vol. I, pp. xix + 648; Vol. II, pp. iv + 517. Price 50s. net.

This splendid contribution to our library of Tropical Medicine is of special interest to all officers, and indeed to all ranks, of the R.A.M.C., partly because it deals largely with the medical history of those climes and diseases which are our special “pigeon,” partly because it honours the memory and details the medical achievements of many distinguished officers, past and present, of our Corps.

The story opens with a fascinatingly breezy chapter dealing with the history of tropical medicine as it affects the Navy and Mercantile Marine. This chapter is of more than purely medical interest, and will appeal to all

amongst us (and everyone in this Island Kingdom of ours should be included in this list) who are interested in the more intimate details regarding the conditions of life (often a very unpleasant and cramped existence it was) of those who, through the ages, have "gone down to the sea in ships."

The second chapter, dealing with the Army is, of course, of special interest to us.

That military life was far from being an easy undertaking in the early decades of the nineteenth century is suggested by a letter written by Sir Andrew Halliday, Deputy Inspector of Army Hospitals. After mentioning that "the medical officer is always despised and disregarded" (more true of peace than war conditions), he remarks that the "many recommendations for cleanliness and the greater comfort of the troops at Barbados, made by his predecessor, had received so little attention that the soldiers preferred to sleep on bare boards in the open galleries (passages or verandas), or were forced to the grog shop to escape the myriads of bugs and vermin that were hatched in the stuffing of their palliasses, and brought forth in swarms ready to devour their bodies."

The great Edmund Parkes—one-time Professor of Hygiene at the Army Medical School and in whose memory the Parkes Memorial Prize is competed for annually—was largely responsible for the great reduction in the incidence of tuberculosis and other respiratory diseases amongst our troops, by procuring more floor and air space in barracks. Down to the time of Parkes it was the aim of those who planned and built barracks to crowd as many as possible into them regardless of site, ventilation, air, and floor space, etc. "Barracks were so constructed that there was every impediment to the free circulation of air, even had the surrounding air been healthy, and abroad they were situated at the edge, sometimes on the lee side of a swamp. It was common for the beds to be placed in long rows, almost touching one another, the rooms being ventilated and lighted from one end only."

When General von Moltke heard of the death of Parkes he is reported to have said that every regiment in Europe ought to parade on the day of his funeral and present arms in honour of one of the greatest friends a soldier ever had.

One cannot claim, however, that the principles of sanitation were wholly disregarded before Parkes' era as the observations on the "Diseases of the Army," written by John Pringle and published in 1752 will testify. Much of what he said still "stands." For instance, "in the dysentery season," he writes, "some light penalty should be rigorously inflicted on every man that shall ease himself anywhere about the encampment except in the privies"; and this at a time when little was known concerning the causation and prevention of the dysenteries.

Note is made of the disastrous Walcheren expedition of 1809 when 30,000 officers and men were attacked by fever with the appalling mortality of 346.9 per thousand. As a result of this and of similar disasters the conduct of Army medical affairs was taken out of the hands of a triumvirate



composed of a Surgeon-General, Physician-General, and an Inspector-General of Hospitals, and put in charge of a Director-General with three chief assistants. The first Director-General was Dr. James (later Sir James) McGrigor, a statue of whom adorns the grounds of the Headquarter Mess.

Speaking of military hospitals, Dr. Scott says "there can be no glossing over the fact that a century and a half ago the hospitals themselves were one of the chief causes of sickness and mortality in the Army. It had been noticed that among the infantry who were taken into hospital for treatment the death-rate was heavy, whereas the cavalry carried their own sick and they were treated regimentally and among them the mortality was slight in comparison, for contagion was fostered by what was called 'the accumulated horrors of hospital miasm'."

At a later date Dr. Knox wrote "the mortality in hospitals after battles is so terrible that I feel convinced it would be preferable to tend the wounded in an open field."

Of 1,000 deaths at Scutari during the Crimean War, only 53 were due to wounds.

Sir Ranald Martin (whose name is also perpetuated in the form of an annual prize), writing of medical arrangements in the field 100 years ago, said, "Where the hygiene of an Army is judiciously regulated, the soldier may be kept in health and vigour; but allow an ignorant general to encamp on a marsh, let filth stagnate, fatigue excessively the men, crowd them in low damp rooms and, despite of drugs, they will fall as unripe and blasted fruit, not by the sword but by the fever." Words which are as true to-day as the day on which they were written.

This absorbing chapter terminates with a brief account of the chief changes in Army medical administration during and since the Boer War. "The South African War of 1899-1902," the author says, "taught us a salutary though bitter lesson, driving home how poor was sanitary organization in the field under conditions of active service. Apart from the medical personnel, neither officers nor men had knowledge of preventive measures, and there was little if any co-ordination between the combatant and medical branches of the Army; in short, this war may be regarded as practically the beginning of the scientific study of disease in the field."

Note is made of the transference of the Army Medical School from Netley to London shortly after the Boer War and the establishment of a School of Sanitation at Aldershot.

As examples of the advance in hygiene achieved during the Great War, 1914-18, the author instances the introduction of prophylactic inoculation against members of the enterica group and the employment of tetanus antitoxic serum, and compares the resulting immunity from tetanus amongst our troops since this measure was introduced with conditions which formerly prevailed. To convey an idea of what this advantage means he records the following account by Blane of a fight at sea: "In April 266 were killed outright on board, 67 died of wounds, 15 with symptoms of the locked jaw.

Few recovered from tetanus and the (occasional) success seemed owing more to something favourable in the man's constitution than anything peculiar to the treatment which consisted in the administration of the warm bath, opium and camphor, with mercurial friction of the jaw." One shudders to contemplate the degree of suffering and the death-rate which would have resulted if no better measures than these had been available for those hundreds of thousands whose stinking wounds must have been contaminated with the highly fertilized soil of Flanders, teeming with tetanus bacilli and their spores.

Now to pass to a brief mention of some of the contributions to the art and science of tropical medicine made by distinguished officers, past and present, of our Corps, and here recorded. Here it must be mentioned that to join the very select company whose researches have been recorded in this encyclopædic treatise one must not only have studied and practised medicine in a tropical country, but must have made some important original contribution in connexion with tropical disease.

Amongst a very limited and exclusive company of pioneers in this branch of human endeavour who receive the distinction of separate biographical notices one finds the name of Sir David Bruce, Commandant of the R.A.M. College during the Great War; and of Sir William Leishman, for some years Director of Pathology, and, later, up to the time of his death at the Queen Alexandra Military Hospital, Millbank, in 1926 (he is stated, erroneously, in this book, to have died at Glasgow), Director-General of Army Medical Services.

Both of these distinguished officers made very important contributions to medical science; both had an international reputation extending far beyond the confines of our Corps; and both had the rare distinction of having a new genus, "*Brucella*" and "*Leishmania*," named after them.

It is interesting to note that some six years prior to Leishman's untimely death at the early age of 61, there was admitted into the Queen Alexandra Military Hospital, where he died, that great medical administrator, William Crawford Gorgas, of the United States Medical Service, to whom imperishable honour is due for his fight, often against the most stubborn opposition, and eventual conquest of the medical terrors attendant on the construction of that great waterway, the Panama Canal. This great American citizen was admitted to the Queen Alexandra Hospital during the summer of 1920, and there had the honour of a personal visit from King George V, who invested him with the insignia of Knight Commander of the Most Distinguished Order of St. Michael and St. George shortly before he died on July 3, 1920.

Our distinguished Director-General, Lieutenant-General Sir W. P. MacArthur, also receives mention in respect of his interesting researches into the mediæval history of leprosy, his writings and lectures concerning which have proved of such absorbing interest to so many of us.

Although but few among us can ever hope to emulate or even approach such classic heights of research as are here so graphically recorded we can,

each and every one of us, do our best in our allotted task to carry on the torch and add our quota, large or small, to the honour and glory of the Corps to which we have the honour to belong. The perusal of this book with its tale of inspiring research, often against seemingly overwhelming odds, may well help us in this task, and it is therefore our duty to read it.

S. S.

**MODERN PSYCHOTHERAPY.** By Noel Harris, M.D. London: John Bale Medical Publications Ltd. 1939. Pp. viii + 144. Price 7s. 6d.

It has been Dr. Harris's intention in writing this book to help the general practitioner to decide which of his patients need specialist psychological treatment, and what such treatment comprises. The general practitioner is aware of the need for such instruction and so, to an increasing extent, is the R.A.M.C. officer, for the Regimental Medical Officer is the first line of defence against psychological casualties in the Army.

The experience of the Four Years' War showed the extent to which the incidence of such casualties could be reduced by medical officers who knew their men, and could discern among them those who were liable to such breakdowns before the breakdown itself had occurred. R.A.M.C. officers, both in the line and at recruit depots, would therefore welcome any book which could help them with this aspect of their work.

Dr. Harris's book contains simple descriptions of the various psychotherapeutic procedures presently in use. Fundamental conceptions of psychopathology are also discussed. Other chapters deal with the factors determining the type of treatment to be employed, the principles of child guidance, and the practice of occupational therapy.

Unfortunately nowhere in this book is to be found the knowledge of which medical officers and practitioners find themselves most in need—namely clear descriptions of the clinical types of psychoneurotic illness and the types of personalities most liable to acute psychological breakdown.

**THE EARLY DIAGNOSIS OF THE ACUTE ABDOMEN.** By Zachary Cope, B.A., M.D., M.S.Lond., F.R.C.S.Eng. Eighth Edition. Oxford University Press. Humphrey Milford. 1940. Pp. xv + 257. Price 10s. 6d.

First written in 1921 with the object of assisting the reader "to attain a correct judgment in the evaluation of the various puzzling symptoms present in urgent abdominal disease" the author, in his preface to the new edition, expresses the opinion that it would "be unwise to make any serious alterations in a book which, judging from its reception by the profession, still appears to meet a real need." This need will continue to persist, and this fine production of the Oxford University Press will continue to be found on the bookshelves of most of the younger generation.

D. C. M.

## Correspondence.

### BLOOD GROUPS.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

DEAR SIR,—With reference to the letter on the subject of nomenclature of blood groups by Dr. N. M. Goodman in the April issue of the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, it is to be pointed out that the official designation of blood groups employed in the British Army is the international nomenclature.

Recently an Army Order was prepared on the subject in order to make the matter clear to all concerned, and the groups are now recorded thus :

AB, A, B, and O.

*War Office,*

*Thames House,*

*Millbank, S.W.*

*April 22, 1940.*

Yours faithfully,

H. MARRIAN PERRY,

*Major-General.*

*Director of Pathology.*



## Notices.

### CARBACHOL.

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A specimen of the Uropac booklet has been sent to us by Messrs. Pharmaceutical Specialities (May & Baker) Ltd., Dagenham, who, we understand, will be glad to forward a copy on request to any member of the medical profession.

### EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

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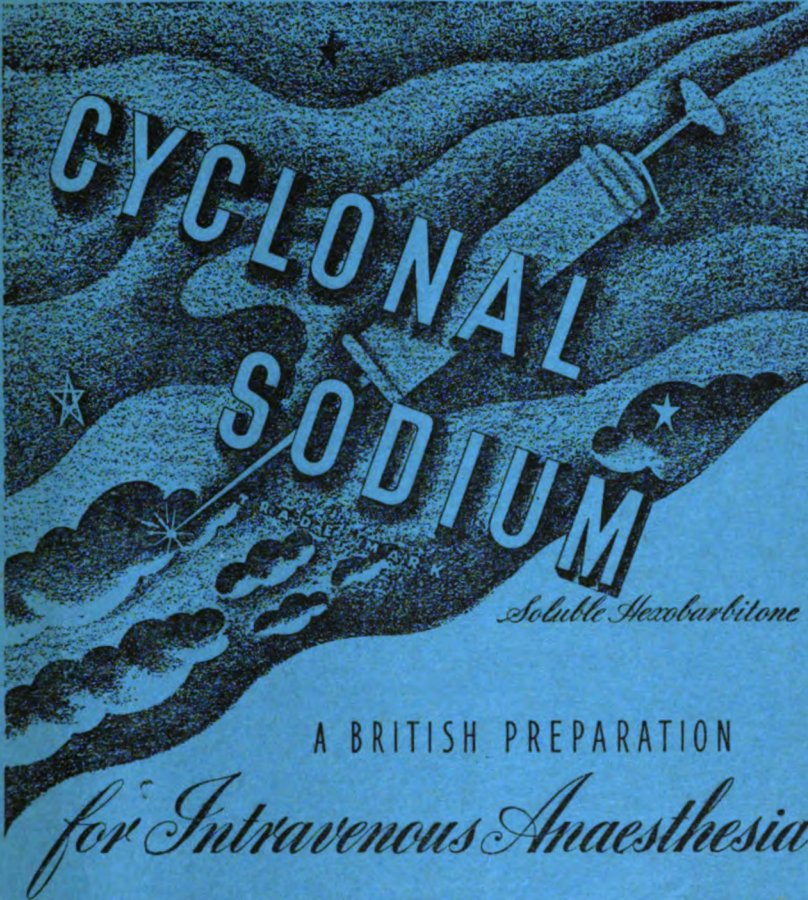
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### CONTENTS

	PAGE		PAGE
ORIGINAL COMMUNICATIONS.		A Case of Strangulation into Waldeyer's Pouch. By Lieutenant-Colonel R. COYTE, <i>R.A.M.C.</i> . . . . . 353	
Surgery in the Army. By Lieutenant-Colonel D. C. MONRO . . . . .	313	A Useful Form for Recording Casualties. By Colonel T. H. SCOTT, <i>D.S.O., M.C.</i> 354	
Anxiety States. By Colonel H. YELLOWLEES . . . . .	327	ECHOES OF THE PAST.	
Some Ophthalmic Problems in Egypt, with Special Reference to Mechanization. By CAPTAIN G. C. DANSEY-BROWNING . . . . .	335	Twenty Years After. By H. SKIPTON STACY, <i>M.D., Ch.M.(Syd.), F.R.A.C.S.</i> 356	
EDITORIAL.		CURRENT LITERATURE . . . . . 361	
The Annual Report of the Chief Medical Officer for the year 1938 . . . . .	342	REVIEWS . . . . . 365	
CLINICAL AND OTHER NOTES.		NOTICES . . . . . 368	
Dieppe Medical Society . . . . .	351	INDEX . . . . . 369	

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*(Continued from page 269.)*

PHYSIOTHERAPEUTIC DEPARTMENT (MASSAGE AND ELECTRIC TREATMENT).

In most hospitals the trained masseur works under your supervision. If possible, he should be made to go round the wards with you to discuss his cases, and should render a weekly report on the progress of out-patients. He is a member of the surgical team. Never send a case to his department with a scrap of paper, on which is written merely "For massage." A *pro forma*, which I instituted some years ago, is now in use in the Army. The main feature of this form is that it insists on the masseur being in possession of the fullest information on the case: what the diagnosis is, for instance, or if for post-operative treatment the nature and date of the operation. The condition for which massage has been prescribed may be something quite different from that for which he has been treated in the ward. The masseur keeps his own register, with notes on progress, and a record of attendances. When massage is discontinued the form may be filed with the case notes, and remains as a permanent record of this part of the patient's treatment.

ADMISSIONS TO HOSPITAL.

*Emergency Cases.*—When an emergency case is admitted to your wards, you will naturally try to see the patient as soon as possible. Should you be out and not immediately available, this duty falls to the orderly medical officer (O.M.O.). It should be an invariable custom for anyone seeing a case on admission on your behalf, not only to make a complete examination, but to record (*in writing* if called away before he can deliver his message in person) his personal impressions, and add such points on the patient's history and state on arrival as are not brought out on the sick report which

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<sup>1</sup> Now Honorary Surgeon to the King and Acting Colonel.

should accompany him to hospital. The O.M.O.'s notes are sent to the ward and should give directions for preliminary, temporary, or symptomatic treatment, as he thinks fit. It is unnecessary to stress the value of such notes when circumstances have made it impossible for you to see the patient until an hour or so has elapsed, and by which time the officer who saw the case on arrival may be absent on other duties. It should also be a standing order that when a serious accident case is admitted or a man in a fit, unconscious, drunk, or arriving after an attempt at suicide, that the wardmaster (senior N.C.O. on duty in the reception room) should take full particulars of names, addresses, and statements, from all who accompanied the case to hospital, noting all these particulars, with the time of admission, in his report book. It not infrequently happens that a case of the class here mentioned, arrives in the early hours of the morning, and is somewhat unceremoniously dumped down by a few excited, mystified, or "exhilarated" companions, or even by civilians who found him on the road. A sleepy and unthinking wardmaster, just sufficiently awake to appreciate that the man's pulse and general condition do not suggest that he is in any immediate danger of expiring, allows the rescue squad to depart. The O.M.O., when he has seen the case, may agree with the wardmaster on the question of immediate danger. You are not called. In the morning you go to the ward and see the case for the first time and the O.M.O.'s notes. If the patient recovers all is usually well, but it may not be so. And all is most certainly not well if the patient gets worse, without regaining consciousness, and dies. Inquiries are instituted, the police arrive, and nobody in the hospital is able to give any but hearsay and very garbled information of the circumstances leading up to the admission. Witnesses have to be traced by mere descriptions, and if a charge of manslaughter or even murder arises out of the case, the guilty party has a good start of the police.

It would appear on occasion even justifiable to take the first opportunity of interrogating a head case who shows signs of recovering consciousness, even at the risk of disturbing the rest to his contused brain, that we all appreciate as necessary. I have vivid recollections of one case, a soldier who recovered full consciousness and most of his memory, and who stated that he had been set upon by two "roughs" in a pub, and that the attack had been deliberate. He described his assailants vaguely, but I was not interested at the time. I persisted in refusing to let the police interview him till he had recovered sufficiently and was unlikely to be upset by a barrage of questions. That man died suddenly on the twelfth day and without having given any useful information to anyone! His assailants, who were anti-social, anti-military, in fact "agin' all government," and had attacked this harmless and well-behaved, though rather elated, soldier, purely in pursuance of their confessed political ideas, were never brought to book for a criminal assault of a particularly ugly nature.

*Interval Cases.*—Most of these will be transfers, or cases you have already examined as out-patients, and whose names have been noted in your waiting

list for operation. It is simply a case of requesting the C.O. or Registrar to get them in on the date you select, and of making your arrangements in advance for any preliminary investigations and for such operation or other treatment as you may consider necessary. It has been my experience that a very large percentage of officers, even many staff officers, in other branches of the Service, are completely ignorant of the regulations concerning the question of the entitlement of officers to admission and treatment in military hospitals (K.R. & Regs., M.S.A., para 275, etc.). It is a good plan to see that these regulations are posted in the officers' ward for all to see, or that some reference to the fact that their admission for conditions which cannot be attributed to military service is a "privilege" is contained on a *pro-forma* used as an admission slip.

The main surgical wards, and the surgical cases in the officers' wards, are usually under the personal charge of the surgeon. In the larger hospitals the surgical division is under a senior administrative officer. Junior officers in sub-charge of other wards are responsible to the divisional officer or surgeon for orderliness, discipline, and case records. Patients will look to the surgeon to direct their treatment, no matter what amount of confidence they have in the juniors. Though sometimes irksome to the juniors, such an attitude is both human and natural; by tactful co-operation a keen junior's ideas may be backed up and his local control strengthened.

While the diagnosis of a patient on admission is in doubt, and while it remains "N.Y.D.," the most likely provisional diagnosis should be written, in pencil, in the correct space on the diet sheet. When the true diagnosis becomes obvious, this can be recorded on the sheet in ink. The object of the "pencil" diagnosis is to keep the C.O. informed during his daily round, at which you may not be able to be present.

Except in special cases, the dieting in a surgical ward can be safely left to the sister in charge. She sees all meals and knows how each patient is reacting to what is set before him. I confess to having felt irritated nearly every time I have signed, at the back of a diet sheet, that I "certify that the articles of diet hereon were ordered by me and were necessary for the patient (or officer)." The signing of such a certificate always suggests premeditated dishonesty. Both the C.O. and the hospital steward have several means of checking extravagance. I suppose such a certificate is part of the intricate machinery controlled by the Army Audit Department for placing responsibility.

In ward management every effort should be made to foster good ward morale. Discipline as seen on the parade ground is out of place with sick men; if you want to see that splendid fellow Thomas Atkins at his best, see him either when he is really sick or in a tight corner. Examine every new admission with the least delay. Nothing undermines ward morale like delay; get on with his treatment, get him up as soon as possible and get him out. Tell him the programme you have in mind for him and elicit his co-operation. Surround his case in an atmosphere of non-communicative

mystery and his imagination may run riot and produce a mild panic. Remember that a young soldier's first admission to hospital can be a very important event in his life. Listen to him with sympathy and examine him either behind screens or, better still, in your consulting room. Fear of ridicule, that mild form of bullyragging prevalent in some barracks, may make him stupidly reticent. It always gladdens the heart to hear a new admission welcomed in the ward by an old hand, with the following type of remark: "You're 'oright mate. We'll soon put you right in *our* ward!" That's the spirit! Such a remark may do far more good than much of our sometimes misguided treatment. It pays to address patients by their correct rank, especially during C.O.'s inspection. Even the latest-joined Guardsman is proud of the term "Guardsman," and a new Lance-Corporal is apt to write you down as unobservant if you do not appear to notice his rank. I am a great believer in getting cases up, even on a couch or wheeled chair, early. There is no better incentive to progress than a view of the outside world or the football pitch from a sunny veranda. It is occasionally forgotten that a patient, particularly after an abdominal section, thinks immobility essential to his recovery. I have known some suffer considerably in maintaining it, and to express amazement and relief when told to move about a bit in the bed.

The report by the night sister should always be read on arriving in the ward in the morning. In this connexion, has it never occurred to anyone as strange that the reports of night and day sisters are invariably written on any old form or blank book which has to be ruled and headed each day? These report books are most useful records on occasion. An official ward report book might be adopted with appropriate headings, and index printed and pages for addresses, next of kin, telephone numbers, etc.

During the last ten years or so there has been a welcome change in our outlook on the question of dressings for wounds. At one time even clean incisions were smothered in layer after layer of gauze, while on top were placed wads and wads of hot wool. Nowadays it is usual to see such an operation wound with nothing but the thinnest covering, or a "cracker" fixed by tension sutures, in fact just enough covering to exert local pressure and to prevent the bedding catching in the sutures. I have seen a whole ward of cases recently operated on and not one had a dressing. They were all healing *per primam*. A sheet of perforated cellophane, which can be sterilized by H.P. steam, strapped on, makes a good protection as well as an inspection window. Some form of sealed dressing, such as elastoplast, is now a commonplace. The value of rest or support is not forgotten, but it is a mistake to render the area uncomfortably hot in attaining these ends. The best dressing for abrasions is Nature's dry clean scab. The same may be said to apply to wounds of the face. Böhler and his followers decry external dressings for compound fractures, and many discharging wounds will do very well if simply covered with a protective cage and the discharge wiped away as it accumulates. The edges of granulating wounds where



the epithelium is commencing to grow in; should be covered with paraffin lint or protective. Having had little experience of treatment of open wounds by direct application of plaster, one anticipates with a certain degree of excitement future opportunities to apply the methods advocated by exponents of closed plaster, more particularly after the recent reports by Trueta of his results in the fighting in Spain. All acknowledge the work of Winnett Orr and his followers, and there would appear to be much evidence which suggests that the deranged local circulation in large oedematous granulating areas actually derives support from the pressure of this form of splinting, a support normally provided by undamaged muscle sheaths and fascial compartments.

I believe that forty-eight hours after a clean surgical incision, by which time the small amount of blood and lymph which may exude has coagulated and dried, the lips of the wound are sealed and protected from further infection and no dressing is necessary. Neither is it really necessary to use a mass of sterile towels when inspecting such a wound. Certainly the wasteful practice of using small "postage stamps" cut from an expensive roll of lint as towels for this purpose, is to be condemned. Ward dressing towels are, however, necessary at times, and I have known ordnance officers to be rather perturbed at the suggestion that the better parts of his old and condemned bed-sheets might be cut and hemmed for the purpose. There is some excuse for such perturbation in India, because the officer has to make certain that condemned sheets are completely destroyed by burning, or they find their way to the bazaars, there to be sold, repurchased by the ingenious linen store man, and used to replace deficiencies in his store. It takes a real Sherlock Holmes to catch out some of these wily gentlemen abroad in this kind of swindle.

Nursing staffs to-day cannot be expected to appreciate what it means to have to dress once or even twice daily a whole ward of hideous open and discharging war wounds. The agony that some of these poor victims suffered often broke their spirit, in spite of every effort to prevent pain from movement and dressings sticking by a liberal use of paraffin strips. One would willingly put up with a whole ward full of mawkish smelling plasters if it would prevent the pain of such dressings. And plaster most certainly would do so. Think of the saving of time and dressings too. When it is necessary to remove a large dressing which is sticking, I have found Higginson I.R. syringe an excellent irrigator. A thin stream of saline and weak peroxide can be directed on to the edges of the dressing by the same hand working both bulb and nozzle, while the other hand assists with forceps. We do not now change dressings on granulating areas as often as we used to. Wright and others taught us the value of pressure and rest for varicose ulcers, and elastoplast was introduced. Not many years ago I saw in India a case with a simple abrasion of the shin, which had become septic, being assiduously dressed night and morning, as part of his routine by a junior Indian assistant, using gauze wrung out in 1:80



carbolic. This had been going on for sixteen weeks ! The local surgeon, not appreciating the situation, was frankly sceptical when a W.R. had been pronounced negative. Little wonder that this innocent wound had been reduced to the state of a chronic indurated ulcer, with heaped-up and almost cartilaginous edges, by this daily insult. Excision of the area and the use of sealed pressure dressing resulted in such rapid healing that the intervention of Allah was not in doubt. More faith in Nature and better understanding of the processes involved in the healing of a wound and the exemplary attention to routine duties exhibited by this subordinate would have been better rewarded.

*Operative Work.*—Keep a calendar in the theatre in which you can write up your lists for operation in advance. Always remember to inform a patient that you intend to operate ; permit him to question you freely, and reassure him. It is rare for a man to refuse operation if he has had ample opportunity to ask the why and wherefore in advance and is asked to co-operate, so to speak. While serving abroad a soldier's C.O. acts in *loco parentis*, but at home it is necessary to obtain written permission from parents or guardians before operation is performed on a minor. In any real emergency, however, this precaution is not necessary, and the surgeon will always be backed up in official circles should the case terminate fatally.

To even the stoutest heart an operation may be an ordeal. Let us never forget that. To a patient with no previous experience of an operating room an operation, no matter how trivial or routine to the surgeon, will be regarded as a momentous event. His first excursion into the dark regions beyond consciousness may be fraught with considerable dread, if not regarded with foreboding.

Unless rendered adequately amnesic by premedication, a patient should not reach the anæsthetic room until the anæsthetist is ready and waiting for him. The orderly who goes to the ward to fetch a case for operation can do a great deal to reassure the nervous patient by tact and gentle banter. What a change this last century has seen in the paraphernalia associated with the anæsthetist ! Twenty years ago we had no qualified specialist anæsthetists, although every officer was supposed to be able to administer one. In spite of this there were always a few who would run a mile to avoid being asked to do so. Other officers, with no special training—in fact “keen amateurs”—could be depended on to keep a patient comfortably relaxed through a longish operation without the veritable maze of cylinders, taps, tubes, and bobbins that modernity and increased knowledge now demand. An open mask and C.E. mixture was found adequate for the vast majority of the wounded in the last war, and the apparatus can be carried in the pockets. Naturally in past years we had trouble at times, but the worst kind of trouble came from the too self-satisfied anæsthetist who approached his victim with an array of gags, tongue forceps, etc., and after a cursory auscultation of the præcordia which should have been done quietly in the ward the day before, pounced on his victim from behind

with a saturated mask, commanding him to "Breathe in—and don't struggle!"

To me, and I feel sure to others, the atmosphere of a well-ordered operating room suggests calm efficiency. The keynote to this is team work. In other words, a thorough understanding between the surgeon, his assistants, and staff. The watchword should be silence; without it, concentration is liable to relax. Clouston, in an excellent article published some years ago, remarks how often the wrong answer is given to the question: "Who is the most important person in the theatre?" In numbers of instances the answer will be "The surgeon, the anæsthetist, or the sister in charge." How very far wrong such answers are!

When working with regional or local anæsthesia, that is to say with a conscious patient, see that knives and other worse horrors are not handed to you past his face. Neither should it be necessary to ask aloud for the knife. A nod or a sign should suffice. I believe it is better to screen off a patient who has had little premedication, rather than to bandage his eyes. Imprisoned, as it were, in darkness and with nothing visual to distract his attention, many will react acutely to trivial subjective sensations. Aim at making your work, in all its aspects, painless. A painful operation under local or a painful "spinal" will bring both these excellent anæsthetics into disrepute. Such an occurrence undermines confidence, leads to talk in the wards later, and has been known to initiate a strange epidemic of post-spinal headache.

Whereas speed in operating, provided that it entails no sacrifice of care, is desirable, it is not nearly so necessary as it used to be, because the more modern anæsthetics have little cumulative effect. We hear less nowadays of Mr. X. who could do a certain operation in some incredibly short time. Watching many of these Mr. X.s at work, one used to be impressed more by the amount of rending and blunt dissection that their methods demanded, than by the time taken to carry out the operation. Should anything happen to spoil the record there was wont to follow a pathetic exhibition of temper, and the sorely tried staff were apt to be the victims of it. Such operators are now rare. The writer was fortunate to have had the opportunity of assisting two of the best surgeons the Edinburgh School has ever produced. One of them never wore gloves and his neatness and dexterity with a scalpel were things to marvel at. Coupled with an exceptional knowledge of anatomical facts and relations speed was assured, and his incisions healed with a minimum of local and general reaction.

The late Sir David Wilkie published an article in January, 1930, in the *Journal of Surgery, Gynaecology and Obstetrics* under the title "Some Principles of Abdominal Surgery." This part is well worth repetition.

"The capacity of the peritoneum and the abdominal viscera to tolerate even gross interference has been fully tested during the past 50 years and has formed the basis and the backbone of modern surgery. So great is that tolerance that we surgeons are apt to presume on it and to lose that sense of reverence for living tissues which should be a fundamental law in operative

surgery. By an elaborate ritual we endeavour to insure that our operations shall be aseptic; but ritual without reverence may be a mockery, and technique associated with trauma will be tolerated less well than much less perfect asepsis but perfect handling. If we had to epitomize our guiding rules of surgery of the abdomen, I believe we might correctly do so by stating 'No traction, no tension.' The primary impression conveyed to the mind at the first sight of the interior of the normal abdomen is the remarkable flaccidity of all hollow viscera; in quietness and in relaxation lies their strength. When disease and operative measures interfere with this relaxation and introduce tension, trouble and pain result. Our guiding principle thus will be to relieve tension when we find it, and so plan our operative work that neither during nor after operation shall tension on the abdominal wall, the viscera, or the mesenteries be present. . . ."

"If we visualize the tissues as living, delicate cellular structures, we become less and less intrigued with elaborate mechanical appliances, such as powerful self-retaining retractors and mighty crushing clamps, instruments which not only injure directly the patient's tissues, but blunt obliquely the surgeon's sensitivity. Retractors should be used to retain out-of-the-way tissues which have been gently pushed aside—too often we have seen them used as if they were weapons."

It is still common to hear ligature material blamed when collections of serum or sero-pus appear in operation wounds made under aseptic conditions in a clean field. Is it not possible that trauma has in reality been responsible? The power of healing possessed by healthy tissues is one of Nature's marvels. But even the most healthy tissues will resent the presence of the most sterile foreign body if those tissues have been previously bruised. Teach your assistants to swab by firm pressure and quick release. Why use a swab as though attempting to burnish the wound? Which method will traumatize the delicate tissues most? A clean purposive incision, made with a sharp scalpel, causes a minimum of trauma. Avoid scratching, scraping, and pricking about. Should an operation wound become acutely inflamed in spite of all due precautions and the greatest gentleness, it is possible that a septic focus within the compass of the area lymphatic system has been missed. The patient may have a septic focus in the tonsils or teeth. The infection is autogenous. I can recollect such an instance. In adjoining beds were two men on whom I had operated. In the case of Pte. A. I had removed, *secundum artem*, a knee meniscus which had been torn and displaced. On the seventh day his temperature rose and the knee became swollen and painful. I removed the dressings to inspect the incision and joint and found the former more red than I liked and the joint tense, hot, and tender. Aspiration revealed infection, and in panic I almost made plans to pack my kit and ask for leave—in fact do anything to get out of the station before amputation became necessary. On the tenth day, however, the man complained of sore throat, and to my relief I found two large infected tonsils, and under appropriate treatment both throat and knee cleared up, but that man was off duty for some weeks. The other, Pte. B., was a grand type of old soldier who accidentally had driven a meat chopper covered with fat, hairs, etc., into the outer aspect of his knee-joint just

beside the patella. The hospital was close to the cookhouse, and the victim reported direct with a bit of dry floorcloth wrapping the joint. On removing this first-aid covering I exposed a gaping wound, from which synovial fluid was oozing, and I could see that there was a split in the articular surface of the anterior aspect of the external condyle. He was taken to the operation room, anæsthetized, and wound toilet carried out. I excised the bruised wound edges, washed out the joint and sutured the synovial membrane, leaving the capsule and skin merely approximated, and splinted the limb. During the next three days I waited for the inevitable signs of infection. That wound had healed on the tenth day, and by this time the patient was walking and entreating me to be permitted to return to barracks. He was back at duty in three weeks with a joint which appeared as sound as its fellow !

I believe that the element of trauma plays such an important part in the smooth healing of operation wounds and in the liability to post-operative complications, that I have never been impressed with the absolute necessity for separate clean and septic theatres. I realize that this statement borders on heresy, also that I should find it difficult to produce convincing proof of innocence or a sound defence should a wound "go wrong," when a previous case dealt with in the same theatre on the same day was known to have been heavily infected with a hæmolytic streptococcus for instance. But I should be the last to carry out the second operation under the circumstances before the theatre had been thoroughly swabbed down, and well ventilated. Even so, I would be more inclined to look for some error in technique than to blame contamination from the previous case. The main reason for having a second theatre is that it saves time. A clean case can be tackled without the delay due to the necessity for swabbing down, before the operation proceeds. By employing a correct order of precedence with cases, both types can be dealt with in the same theatre. In my experience it is common in the Army, when a second theatre exists, for this to become converted into a combined plaster room and fracture clinic, and for both purposes it is very useful. When there is no septic theatre, the majority of minor septic operations can be performed in a theatre annexe, and this will reduce very considerably the amount of floor and wall swabbing which would have been necessary had the main theatre been used. In larger military stations the question of the possibility of expansion for war has to be taken into consideration ; a second theatre will then become an asset. The surgery of war is a specialized form of traumatic surgery in which the excision of bruised and devitalized tissues is a fundamental factor ; it behoves us to see that we do not convert our operation wounds into war wounds.

When dealing with minor septic conditions requiring incisions, it saves labour and minimizes soiling of towels, basins, and theatre furniture if a purely antiseptic technique be employed. Septic infections of the hand can never be included in this minor category. For the usual abscess a short anæsthetic suffices. There are few which cannot be dealt with under nitrous

oxide, and this has advantages over the intravenous anæsthetics when it is not intended that the case should be admitted or detained as recovery is rapid. A scalpel or bistoury, sinus forceps, and scissors usually suffice for instruments. These, with a few pledgets of wool, are put into a basin containing antiseptic. The anæsthetic is not commenced until the patient is "positioned." A clean mackintosh is placed under the part and a warmed kidney tray held in such a position that the discharge will trickle into it. Assistants place their hands on a leg or arm, to steady the patient, but there should be no suggestion in this action of restraint; the patient should be informed that he is not being held down, but merely steadied. If the gas be properly given there should be no struggling, and little jactitation. The operation should be the affair of a moment. The scalpel in the gloved hand makes the stab and outward cut without permitting the pus to touch more than the instrument. If necessary, the incision is widened with forceps, but it is seldom necessary to introduce a finger, because as soon as the overlying skin and fascia have been incised the abscess will evacuate itself naturally. It is not necessary to "rootle round" with a finger, unless there be definite evidence of loculation; even then, intervening partitions should be broken down with the greatest gentleness. While it is most unwise to explore forcibly with the gloved finger, it is criminal to use a spoon. Most of us know of instances where dangerous septicæmia has occurred after a misguided attempt to express the core of a septic skin focus. Nature is doing her best to wall off and localize the infection. Break down the barrier, and spread is rendered possible. Forcible exploration in abscess cavities has been known to start serious hæmorrhage, by rupturing blood-vessels, which can sometimes be felt traversing the cavity. Incision is made only with the object of relieving tension, for this reduces pain, decreases toxic absorption, and hastens recovery. Where the cavity is deep and a tube seems to be indicated, it is a mistake to insert it just as the gas is wearing off. Who has not seen a well-given anæsthetic ruined by doing so? Either put in the tube while the patient is well under or wait till he is fully conscious and can appreciate what is being said to him. Then explain to him that the operation is over and that you must insert a tube and that it may hurt a little; he will not mind and will lie still. Do this when he is half round and more than likely he will wake with a yell, scattering instruments and staff, and let you know in no uncertain terms that he felt the whole "blue pencil" operation. He will not be impressed if attempts are made to explain that he did not feel the cut; he cannot dissociate the two causes of pain. Hurt him and you damage the anæsthetist's reputation and your own, because the occurrence will be luridly described when he regains his bed. Using the simple bag and mask, and suitably spaced breaths of air, it is possible to keep a man anæsthetised with nitrous oxide for a long time, while a painful dressing is done. Why do we still see on occasion a person who has been asked to give a "whiff," smack the patient's face just after the mask is removed? Smacking will not dislodge dentures from the pharynx or relax a spasmodic jaw. A patient with a spasmodic jaw, even though his colour be puce, can wait a while

and will come round presently without interference. The pale case with relaxed jaw will not respond to smacks though! He requires something else, and his condition may well give rise to anxiety. Anyone who has had gas will agree that coming round may be both pleasant and amusing, but like a dream which is said to be due to some waking stimulus it can be very greatly influenced by waking impressions. Speaking of dreams, my cabin mate on one sea trip was a heavy smoker and mouth-breather—audibly so! He invariably reacted in the same way when I woke him by trickling a thin stream of cold water down his cheek into the dry mouth. Sitting up, he gazed for a moment round him, looking horrified, then seized his lifebelt. I had to escape quickly to avoid his later and more conscious reactions. I can recollect a patient coming round from gas respond in much the same way because he heard an assistant remark "Ready to cut." It was some time before the man could be persuaded that he had had his operation and that the remark he had heard referred merely to Christmas hams. Let a patient who has had gas come round in silence and in his own time, and without socking him on the jaw or drowning him with water. If there is conversation, it is a good tip to block his ears with the palms of your hands until that unmistakable expression in his eyes which indicates returning consciousness has been replaced by one of puzzled and fascinated amusement. If he should then burst into song or roars of laughter, and end by calling sister a darling—what does it matter? He has probably merely forestalled the whole staff by stating a fact which they hesitated to mention, and for the rest, is simply expressing the joy of living.

I have lived to see intravenous basal anæsthetics largely replacing  $N_2O$ . I have had both. Both are pleasant, but gas only so if not rushed during induction. I have never seen a fatality that could be attributed directly to gas and, like most of us, know hundreds of patients who think one or the other marvellous.

#### SURGICAL EQUIPMENT.

The peace-time surgical equipment in the Army, though it may appear lacking in some respects by comparison with that of many civil hospitals, is ample for our purposes. There is no surgical emergency which could not be dealt with adequately with the instruments available at any of our surgical centres. The necessity for a large degree of standardization demands a system of supply in the Army which makes it impossible to cater for individual preference concerning items. The young surgical specialist will soon find out that it is a wise precaution to possess a few pet instruments, which he must purchase from private funds, and can carry about with him. While serving abroad, it is not uncommon for work to be held up because one of the more complicated items, such as a cystoscope, requires repairs. Skilled instrument technicians are scarce in the colonies and dominions and the damaged instrument may have to be sent away, so that one is without it for two or three weeks. The obvious remedy is to stock spares in stores depots, but it must be admitted that this remedy is expensive; I believe, however, in the end it would save money to the government concerned

because the cost of retaining cases in hospital pending the necessary investigation and treatment, which is considerable, would be saved.

#### RECORDS AND REPORTS.

Detailed notes of all major operations performed must be entered in the Register of Operations (Army Book 485). The notes should indicate the technique followed, record difficulties encountered, and note in the remarks column the result of pathological investigations. Your own memory may not require the aid of such notes, but they may be of much value to your successors.

To enable him to keep in touch with the surgeons working at home, a monthly report is submitted to the consulting surgeon. At the end of the year the annual report is compiled from copies of these and other data in the registers. When the excellent opportunity for follow-up in an organization like the Army is considered, we might make more use of our clinical material. A soldier can be traced from the day he enlists until he dies, or returns to civil life on or off the Reserve, with comparative ease. The *Corps Journal* has often contained excellent accounts of interesting or atypical cases, but few of studies of a group of cases and their after-histories or progress. The truth is, most surgeons have no time for so doing.

#### CONCLUSION.

"There is no doubt (Mr. Zachary Cope says) that surgeons at hospitals are worked harder than in past years, if the number of operations can be taken as a criterion." He goes on to say that at one London hospital the number of operations in 1906 was 1,632, and that in 1938 this number had been more than doubled. "These statistics show that the increased work has been thrown on the individual surgeon." What is more, the scope of surgery has greatly increased in the last twenty years. What Mr. Cope says of civil surgery certainly applies also to surgery in the Army. An increase in the numbers of officers specializing in surgery is necessary.

I have known it to be exceedingly difficult for surgeons to get the time to study war organization, or to take part in field war exercises. It may handicap them in later years. As soon as the Army leaves a peace footing, special qualification in professional subjects may have to be subjugated to the major demand for those with knowledge of organization. Our energies must be pooled in the common effort to assist in organizing and in collaborating with our civilian colleagues, who join us after mobilization, and without whom we could not carry on. It is a case of *collective effort* with the administrative officers most in the limelight. During peace, on the other hand, collective effort tends to be overshadowed by the individual efforts of each officer, N.C.O., and man. The more each *individual's ability* is subjected to public scrutiny and trial, the greater is that *individual's personal responsibility* in maintaining the reputation of the Corps. All must admit that if the question as to whether a medical officer should be primarily doctor or primarily officer were put to the vote of the Army as a

whole, the verdict in favour of the former would be overwhelming. Our "public," that is to say our patients in and out of the hospital in the station or community where we work, to say nothing of their families, relatives, even their friends, rightly demand of us that we should be good doctors, sound physicians, and safe surgeons, who can look after them when sick or injured. In peace then, the extent to which we are able to meet this very natural demand is to all intents and purposes the index of our Corps' reputation. Officers may contribute toward the Corps' reputation in a station by social attainments and activities or by prowess in other directions, but if they be engaged in the treatment of patients, it is essential that they possess professional ability. No matter how desirable it is not necessary for them to possess professional eminence. The difference between mere reputation and eminence in the profession is well summed up in the *Lancet*, October 22, 1938: "Professional eminence according to the accepted canons of the medical profession, is based on innate worth and character, something recognized by expert judgements of fellow practitioners, not something conferred by almost accidental verdict of popular opinion." Unfortunately it is a fact that the work of the maternity specialist, the surgeon, and the physician, makes a morbid appeal, where the laity is concerned, to the sense of the dramatic; consequently these officers bear most of the brunt of keeping up our Corps' reputation in a station. The laity does not always appreciate that the officer who toils unobtrusively in an administrative department may be doing work of far-reaching consequence to the Army as a whole. What is more, within the walls of his office and shielded, as it were, by regulations concerning the discussion of official matters in public, he works in a relative "black-out" in comparison with his professional colleague, who is constantly in the glare of the limelight, and a victim to all manner of scrutiny and gossip. Within the narrow confines of station life, and until his ability and personality have enabled him to establish it, the young specialist's professional reputation is about as safe as that of the proverbial vicar's at a sewing bee. None will deny that the very nature of their work brings to the officer engaged in surgical, maternity, or medical work, worries, responsibilities, and exactions, as well as the constant liability to answer calls, which is usually entirely foreign to other officers of the Corps. I am sure that the other officers do realize this, but I hope when they close their office door at 5 p.m. on Fridays virtually assured of a peaceful and undisturbed week-end they will not forget it, and will continue to remain, as I have generally found them, sympathetic towards a plea from one of their tired and overworked professional colleagues, for change and respite. The popularity of the Corps from the point of view of recruitment to the commissioned ranks will always depend on its social and professional status, and the chances it offers for advancement. One bad "doctor" can do more harm than twenty indifferent administrators. Good surgeons and physicians not only raise the professional status of the Corps, but contribute very largely to its popularity as a career.



## POSTSCRIPT.

Before this article was complete we were once more at war. It is strange to see circumstances and difficulties identical with those which occurred during the early months of the Great War, again cropping up, and it is reassuring to find that most have been anticipated. The real problems are known only to the administrative officers. Doubtless we shall again meet the type of emergency commissioned officer, who is inclined to be intolerant of Army routine; any suspicion of "red tape" irritates him. But these rather wordy advocates of short cuts and business methods are incapable, in my experience, of appreciating that modification of a machinery which is built up on years of accumulated experience cannot be effected in a day without upsetting the works. While effective surgery remains the essence of the treatment of most war wounds, there will be the same demand for surgeons. There should be fewer "misfits" this time. There was a good deal of grouching on this score in the last war, as many with more self-assurance than practical experience held surgical posts until a select committee put things to rights. The birth of the team system initiated an all-round improvement in the surgical organization and results. Great strides were made in the treatment, if not in the understanding of the scientific explanation of the shock syndrome, and the early incidence of tetanus fell rapidly by 1917. Reconstructive surgery made headway under the home consultants.

When demobilization came many gaps in civil ranks were filled by young "war surgeons," but the public in some cases, and the more conscientious doctor in others, did not take long to realize that a technique developed largely while wielding a scalpel in the field was an indifferent substitute for actual experience of the class of surgery which every general surgeon in civil practice has to tackle. Nevertheless, the influence which war surgery had exerted in many other directions had come to stay. It was responsible, for instance, for much improvement in methods of treatment of fractures. I believe that Major M. Sinclair, R.A.M.C., an ex-regular surgeon, was the first to advise segregation of this type of case, in war. From this suggestion, and the experience then gained, arose the special fracture clinics for which there had long been a crying need in this country. War surgery initiated many advances in thoracic surgery and provided—unfortunately—many opportunities and much material on which to work out new technique in plastic or maxillo-facial surgery.

This present war will mean privation and suffering to many. It is surely no vain wish to hope that some good will come of it and that surgery will further benefit.

It only remains for me to thank a few who have encouraged me to present this article for publication, and to state that I absolve them from all responsibility and to thank Major-General W. B. Purdon, K.H.S., D.S.O., Commandant, Royal Army Medical College, for his permission to do so, and at the same time to state that the writer appreciates the difficult position in which he placed the Commandant, and admires his temerity!

ANXIETY STATES.<sup>1</sup>

BY COLONEL H. YELLOWLEES.

*Consultant Psychiatrist, B.E.F.*

THE phrase "Anxiety state" appears to be rapidly becoming as notorious in this war as "Shell-shock" was in the last.

I need not emphasize that neither term is a diagnosis. They are both labels for illnesses which we—that is the Medical Services of the Army—regard with distaste, annoyance, and suspicion, especially upon active service. We have no special desire to study them, and no special knowledge of how to treat them. We only know that they have a high nuisance value, that they increase the risks of wastage of man-power and impairment of morale, and that they make it harder for us, in numberless ways, to treat our honest-to-goodness medical and surgical cases and get on with the war.

It is, therefore, just too bad that these illnesses should exist at all, but there it is, and I cannot think that fixing labels to them and then showering abuse on the labels, will do much to abolish them. That reaction is a hangover from nursery days. When we have made our last and funniest joke about "so-called shell-shock," and emptied all the vials of our scorn upon its hapless successor "anxiety," we have not really made any contribution to the problem of functional nervous disorder in war-time. On the contrary, we have merely adopted the infant's method of dealing with an unpleasant reality; the method of calling it bad names, shutting our eyes, and crying, "Go away, I hate you." We open our eyes—some of us—sooner or later, and find to our dismay that there is the horrid boggy, as near and as real as ever.

Now the difference between the "anxiety" label and the "shell-shock" label is just this, that whereas "shell-shock" never pretended to be anything but a label, the term "anxiety state" happens to have a very definite technical meaning in psychological medicine, and connotes a group of disorders with a well-established pathology, symptomatology, course, treatment, and outlook of their own. When we misapplied the label "shell-shock" it was of no great importance because the term never had any scientific meaning, but when we speak of an "anxiety state" we are, or ought to be, committing ourselves to a diagnosis, whether we realize it or not. Shell-shock meant "It may be anything"; anxiety state means "It is something." Hence in the one case a mistake was a pity, but in the other it is a medical tragedy.

In these circumstances I thought that a short summary of modern views on the nature of anxiety states might be of interest to the Society. It will not help us much with the whole vast question of war neuroses, but it is at

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<sup>1</sup> A paper read before the Dieppe Medical Society.

least related to that very specialized study, and can be outlined in terms of general medicine and within the relatively short time at our disposal. May I hope, too, that the time question may stand for my excuse if any of my statements should appear too dogmatic, or my survey too incomplete.

Anxiety states were first brought into prominence by Freud's original paper on the subject, published, I think, in 1896. I am sorry I cannot be sure, from memory, of the exact date. In it he pointed out that the central and essential feature of these states was what he called "Angst" a word of which "morbid anxiety" is the correct and generally accepted translation. We all tend, unfortunately, to become a little slipshod in terminology, and it is important for us to remember, if we possibly can, that strictly speaking "anxiety" is an ordinary, everyday, non-medical word, and describes a normal reaction to certain circumstances, whereas "morbid anxiety" is a medical term, connoting an abnormal reaction. It is the best translation we can give of "Angst."

"Angst" is, of course, fundamentally a mental and emotional state, but like practically all such states, and more strikingly so than almost any of them, it tends to manifest itself by means of the bodily machinery, particularly that of the autonomic nervous system. As a result of this, very many anxiety states come to be regarded by patient and physician alike as cases of bodily illness and nothing more. Our old friend D.A.H. and his young successor gastritis, are two obvious illustrations which occur to me.

Anxiety states are of two kinds: Anxiety neurosis and anxiety hysteria, and it is to the first of these that what I have just said particularly applies. The distinction between the two is interesting but highly technical, and as I shall have to limit myself to anxiety neurosis in our discussion, I have decided to cut out any attempt to differentiate the two main groups in this lecture. For our present purpose we need merely remember that the nuclear symptom, as Freud called it, however it may express itself, is morbid anxiety. This will always be discernible in any examination of the patient worthy of the name, and the diagnosis rests not on the physical signs and symptoms alone, but on these plus the view the patient takes of them, the history of his illness, and his attitude of mind in general.

The bodily manifestations are indeed, to use Freud's word, protean. They include sweating, tremor, tachycardia, præcordial pain, vasomotor disturbance, fainting, vertigo, dyspnœa, asthma, nausea, retching, vomiting, diarrhœa, polyuria, paræsthesiæ, neuralgic pains, and many more. Naturally it is unlikely that all these will appear at once in the same case, but every case shows a selection of them, grouped in varying proportions, and with varying degrees of acuteness or chronicity. And in each instance, behind these bodily disturbances, and colouring them all, is the central symptom of morbid anxiety, which may be anything from a certain difficulty in collecting one's thoughts and "pulling oneself together," to the classical acute anxiety attack, in which physical and mental symptoms combine to present a clinical picture which, though usually misdiagnosed, is rarely forgotten.

Now a few of the symptoms mentioned, in very minor degree, are I think, within the personal experience of almost anyone who has ever gone up for a *viva voce* examination or even addressed a medical society, but a striking resemblance to a well-established, good-going anxiety state is repeatedly seen in cases of exophthalmic goitre. The not-uncommon thyrotoxic cases in which there is no exophthalmos or thyroid enlargement are often practically indistinguishable from anxiety neuroses. The commonest error in dealing with anxiety states and, indeed, with all neuroses, is the tendency to assume disorder in, and therefore apply treatment only to, those organs to which the patient refers his symptoms. The cases of "effort syndrome," late D.A.H., are sent to the cardiologist. Patients who complain of digestive trouble, by far the commonest original complaint of neurotic subjects—do you mind if I repeat that ? *by far the commonest original complaint of neurotic subjects* ; thank you—go under the care of the stomach specialist. Hysterical paralyses go to the orthopædic surgeon, and functional aphonias to the throat specialist. A few years ago a group of eminent genito-urinary surgeons held a discussion on "the sexual neuroses," and quite recently a first-class obstetrician of my acquaintance "treated" chronic masturbation in one of his patients by amputating her clitoris. As far as I am aware, amputation of the penis is seldom resorted to for similar trouble in the male, but if this sort of thing is really "treatment," then we may as well push it to its logical conclusion. We should provide a piece of toast for the gentleman who considers himself a poached egg, and we should order the patient who believes he is made of glass to receive periodic special treatments from the window cleaner.

You will note that we do not fall into this error in, for example, a case that we have succeeded in diagnosing as thyrotoxicosis. In that case we go all scientific and take no particular note of the patient's actual complaints, because his basal metabolic rate has, so to speak, given the show away. His thyroid gland stands convicted as the villain of the piece, or, should I say, the real cause of the trouble, and we fall upon it thankfully, supported by the surgical specialist and the X-ray specialist. The patient often recovers.

It is clear, therefore, that if we are to understand anxiety neurosis properly and deal with it effectively, we must turn our attention to the morbid anxiety which is its fundamental symptom. I need not say that I am making no attempt at a full exposition of one of the biggest and most difficult subjects in medical psychology. I shall give but a brief and incomplete outline of it, choosing out of its many aspects the one which seems most suitable for our present purpose.

All anxiety, normal or morbid, is, in its essence, a mixture of two great opposites, desire and fear. The truth of that statement is delightfully illustrated by our everyday, colloquial use of the word "anxious." "I wish it would stop raining," we say, "I'm anxious to go out." But we also say, "There's no improvement in Smith's case ; I'm getting very anxious." Before the murder of Duncan, Macbeth was in a pitiful state of anxiety, and

what his wife said was that he was "letting 'I dare not' wait upon 'I would'."

Now morbid anxiety very very rarely, if ever, appears suddenly as a bolt from the blue in a previously healthy individual. It arises in people who are predisposed to it because this clash between desire and fear has been the keynote of their mental attitude and character for years. They have been "letting 'I dare not' wait upon 'I would'" for so long that they have largely ceased to realise the fact. It has become their habitual and characteristic response to life. It is not hard to see how this arose. The simplest and commonest and worst method of dealing with tendencies and activities which we consider to be undesirable in a child is, of course, to make him afraid of them. This was the speciality in which Victorian parents excelled, but we are perhaps hardly so far ahead of them as we like to imagine. Almost every natural childish activity had some mysterious, illogical, and terrible punishment attached, varying from solitary confinement on light diet for such lesser offences as climbing trees or stealing apples, up to the wrath of God, plus a beating from Father, for showing undue interest in one's sexual organs or those of others.

Now of course it's not quite as easy as that really, but that is the sort of thing which resulted—and results—in the production of people whose fundamental attitude of mind to all life is a mixture of desire and fear, an attraction towards, counteracted by a shrinking from. They are the army of the psychologically half-hearted, and note that they do not realize it, any more than any of us are clearly conscious of our habitual gestures, or our tricks of gait, or accent. It is just part of them. Naturally this attitude will tend to become obvious when the individual is struggling to adjust himself to the subject with which are associated our strongest desires and also our most powerful prohibitions and taboos. And so it comes about that anxiety neurosis is abundant in late adolescence or in early adult life, and that a maladjustment to sex is almost always a part of the picture.

Do let us remember that this is by no means a matter of seeing both sides of a given question, and consciously weighing up the pros and cons. If the anxiety neurotic could appreciate a situation in that way it would be the saving of him, but it is the very thing of which he is incapable. The more clearly the clash between desire and fear is realized, the more does the anxiety become normal and not morbid, and the easier is it for the individual to find means of outlet—and there are means—for the tremendously increased nervous tension, when neither desire nor fear will yield. But that relief is not for the anxiety neurotic. It is not easy to deal with a situation which one not only does not understand, but of the very existence of which one is not clearly aware. The mind of the anxiety neurotic is a house divided against itself. His trouble is deeper than logic or consciousness, and he only knows that the very idea of resolute action in any direction floods his mind with all sorts of doubts and misgivings the nature and origin of which he cannot now in any way understand. It is the lack of outlet and the state of tension so produced that form the background of all anxiety neurosis.

Now of course all this varies enormously in degree, and may very well pass unnoticed till the individual is faced with a situation which proves too much for his limited powers of adaptation. But, and this is the vital point, the actual external situation has really very little to do with the matter where morbid anxiety is concerned. Let me try to make that clear. We are all so made that we cannot experience an emotional state for any length of time without finding some object in our environment to which to attach it. We cannot merely be angry ; we must be angry *with somebody*. We cannot merely be afraid ; we must be afraid *of something*. As I am sure most of us realize by now, the particular object on which we discharge the venom of our latent irritability on any given morning, is almost entirely a matter of chance. If the eggs, for once, are all they should be, there is always the matter of the hot-water supply, and if that should have failed to live down to its reputation, one can fall back on the unpleasing appearance or habits of some colleague. As a last resort, there is the inexhaustible subject of the War Office. Not only do we make such things the outlets for our irritability, but we actually succeed in convincing ourselves that they are its cause, forgetting that, if so, the result apparently came first, and the cause followed some time afterwards. This of course is precisely on the level of the Germans and Mr. Churchill, but it is a well-nigh universal reaction, for all that. It takes the most stable of us all his time to avoid this pitfall, and certain ranks—proverbially full Colonels and Sergeant-Majors—are said to find it impossible to do so, but the anxiety neurotic doesn't even begin to try. Though he will naturally prefer a situation which, on its own merits so to speak, would tend to rouse apprehension in a normal person, he attaches his anxiety in some degree to any and every circumstance or situation in his daily life. Both patient and physician then draw the mistaken inference that the situation in itself is the "cause" of the abnormal symptoms, and the way lies open for mistaken diagnosis and misdirected treatment.

To the typical anxiety neurotic, the mere sight of a policeman suggests the thought of arrest and punishment ; all telegrams suggest possible bad news ; every stranger might be a thief and a robber ; and every summons to the chief's office may mean the sack. He cannot explain it, understand it, or reason it out. He's not afraid, he will say ; why should he be ? His common sense tells him there is nothing to be afraid of, but the harder he struggles to reassure himself, to scold himself, or to laugh at himself, the more inevitably does his pulse-rate begin to rise, his heart to palpitate, his limbs to tremble, his hands to sweat, and his very bowels to turn to water.

Now if such a person is faced with a situation involving risk of death or pain or discomfort, he will no doubt show these reactions, but that is no evidence whatever that he is any more "afraid" of the situation than his neighbour is, still less that his symptoms are merely an elaborate attempt to avoid his responsibilities and shirk his duty. It may quite possibly be so, because, although the level of physical courage among anxiety neurotics is probably higher than in most other sections of the community, there are good

and bad in all groups. The point, however, is that without evidence of a totally different kind from that provided merely by the bodily and mental symptoms we have mentioned, it is grossly unfair to suggest that the coward and the anxiety neurotic have anything in common. Death and hardship and pain are not necessarily the things of which he is "really afraid" any more than he is "really afraid" of the stranger or the telegram or the policeman or the chief.

That is the crucial point: the comparative irrelevance of the situation, and its outcome, to the morbid anxiety which the patient attaches to it. That is the whole meaning of the word "morbid." The situation is not the cause of the anxiety; it is the occasion and the opportunity—one of an infinite series—for something already in the patient to manifest and express itself.

Strangely enough, when any given situation does actually turn out unfavourably, it is quite often all the better for the patient. If the letter contains not bad but good news, or if the visitor is not a burglar after all, but a kind friend, the patient's morbid anxiety is in no way relieved. Why should it be? There will be plenty more letters and visitors to agonize over in due course. But, on the other hand, if the blow really does fall, the patient, to begin with, experiences the unique joy of being in a position to say, "I told you so." Further, now that the worst has happened he is, for the moment, released from his forebodings, and very often he may be temporarily stimulated into displaying the efficiency, the courage, and sometimes even the heroism of despair.

How utterly different is all this from the simple anxiety of a normal man with all his psychological cards on the table, so to speak. The cause of *his* anxiety resides in the uncertainties of the situation, and when the situation is resolved one way or other no further anxiety remains. If the worst happens the ordinary man accepts the fact, and does his best to act efficiently about it and get what is possible out of the wreck. On the other hand, if things turn out well, he thanks God and takes courage, experiencing a glorious sense of relief to which his neurotic brother is for ever a stranger. Perhaps a final homely illustration may show up the contrast clearly. Some weeks ago a senior officer came into my office, looked at me without speaking for a moment, and then said quietly and seriously: "I want to ask you something." Well, I don't pretend to anything more than a reasonably clear conscience, and I cannot tell how those of you who have stainless ones would have reacted. I only know that to my fury I became conscious of a group of anxiety symptoms rising within me with an ever-increasing force. I won't say that all my past life flashed before me—it wasn't as bad as that—but many grim possibilities ran through my mind while I waited what seemed about twenty minutes to hear the question. When it came it was a perfectly ordinary matter of business which I answered on the spot in a word or two. But then, and this is the point, I gave away the entire show by saying, tactlessly perhaps, but with a sigh of immense relief, "I thought it was something important!"

Well, gentlemen, that is the best I can do in the time at our disposal, and you will naturally expect me to say something about treatment before I sit down. It is not entirely lack of time which leads me to compress what I have to say about that into a very few sentences. I have outlined a disorder which to my bigoted mind seems intelligible enough, and which involves conceptions and theories which do not seem to me to be any more complicated and far-fetched than many of the physiological theories which we invoke so readily, not to say glibly, in ordinary medicine. But if you insist that it is a thoroughly difficult and specialized business, as indeed it is, then you can hardly help agreeing with me that its treatment is a matter for the trained specialist. I say that with every pleasantness, but with all sincerity. The untrained man should be as unwilling to accept the responsibility of treating an anxiety neurosis as to accept that of personally operating on an appendix abscess. In the absence of trained specialists, the untrained man does his best, and sometimes it is an amazingly good best. It all depends on the man, and we can't open up the subject now. We can say, however, that a thoughtful and careful man will find various minor uses for some complicated instrument, such as the great science and art of psychotherapy, even though he does not fully understand its powers and functions, and has not been trained in handling it. A bumptious ass will harm his patients and ruin the instrument.

Cases of obvious and well-established true anxiety neurosis, while not rare, are by no means abundant in this area just now, but an immense amount of minor and ill-defined neurotic reaction and faulty adaptation to present conditions does exist, for which "anxiety state" has become one of the recognized waste-paper baskets. Now, as I said at the beginning, this is lamentable from a medical and scientific point of view, but I am quite prepared to admit that at this early stage in the development of the psychiatric branch of the medical services, it is a labour-saving device which is not without its practical and administrative advantages. My own feeling is that at the present stage, having given this outline of the perfectly good illness whose name we are apt to take in vain, there is no further action I feel called on to take in the matter.

May I speak for a moment in a more general way, in closing ?

True war-shock or anything remotely resembling it has not yet arisen. The word "war-neurosis" as yet means absolutely nothing with regard to this war. A junior officer from another area, who was not in the last war, and has now been in France for three weeks, came to see me the other day and informed me that he had just given a lecture to his fellow officers which had been well received and had aroused much interest. His subject was "War Neuroses." To quote Shakespeare once again : "I was not angry since I came to France, until that instant." If and when we *are* faced with real war-neurosis, Army psychiatry, which is always the most fascinatingly interesting of the medical services, will become one of the most vitally and urgently important, and will stand or fall by the way in which it deals with the situation.



Meanwhile there is plenty to do in the way of organization, preparation, weeding out, and the routine work with nervous and insane patients. That is not our present concern, but I must say here a word in recognition of some of the splendid bits of medical work done by individual medical officers in hospitals in this and other areas, with isolated cases of neuroses of all kinds that have cropped up. There have been some brilliant results of the attempts of these men to apply modern curative psychological treatment to the cases that have come their way, and I cannot think it is mere coincidence that the wards of the general duty officer who "does the psychiatry" are so often regarded as the most interesting in the hospital.

But apart from the routine things, we are faced with one new and great psychiatric problem, which was perhaps not quite fully foreseen, namely the difficulty of enduring with unimpaired cheerfulness, efficiency, and morale. *not* strain, privation, exhaustion, bombardment and the risk of wounds and death, but inactivity, boredom, minor discomfort, monotony and, above all, absence of opportunity to do the work that we know and love, and that some of us have perhaps given up a good deal for the chance of doing here. Well, there's material for another lecture or two in that, but I must point out how it brings in at once that fundamental question of lack of outlet, and so predisposes the whole lot of us to anxiety states. For believe me, this particular trouble is as prevalent, to say the least, at the base as it is at the front, and I have seen a good many cases, not only among the patients, but among the medical officers who look after them. Further than that I cannot go. Details of prophylaxis and treatment would require another lecture—or perhaps a private interview would be better! But improvement always follows upon realization and acceptance of the position, and once that has been achieved the prognosis, you will be glad to know, is almost invariably excellent.

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## SOME OPHTHALMIC PROBLEMS IN EGYPT, WITH SPECIAL REFERENCE TO MECHANIZATION.<sup>1</sup>

BY CAPTAIN G. C. DANSEY-BROWNING,  
*Royal Army Medical Corps.*

THE title of this lecture was chosen to draw the attention of medical officers to four subjects of general, as well as of ophthalmic interest, which have been brought to the fore by the recent intensive mechanization in this country.

These subjects are :—

- A.—Trauma.
- B.—The ophthalmias.
- C.—The heterophorias.
- D.—The ophthalmic problems of war.

### A.—TRAUMA.

In Abbassia, continuous regimental driver-mechanic courses, together with the workshops of the Royal Army Ordnance Corps and the Royal Army Service Corps, cater for the maintenance of all types of mechanical vehicles. During the last three years, especially in the Zafaran area, there have sprung up workshops for all branches of the so-called "metal trades." In fact, nowadays, the R.A.O.C. and the R.A.S.C. run large factories with special departments for oxy-acetylene welding, casting, soldering, turning, boring, riveting, paint-spraying, and "blacksmithy."

The personnel of these shops is a mixture of skilled and unskilled labour, the latter mainly Egyptian, working at trades which hold the highest ophthalmic risk.

Throughout this lecture, when drawing your attention to various statistics, an attempt will be made to carry out Andrew Lang's precept that statistics should be used, not as a drunken man uses a lamp-post for support, but for illumination.

In Great Britain, in 1911, there were estimated to be 26,000 blind persons. In Great Britain, in 1931, there were estimated to be 66,000 blind persons. Only the most hardened cynic can put the increase down as solely due to the Blind Pensions Act.

The report of the "International Association for the Prevention of Blindness" to the "XV Concilium Ophthalmologicum" in 1937, stated that 20 per cent. of these blind persons sustained their disability at their work. Of these occupational injuries, some 50 per cent were sustained in the "metal trades." Also it was noted that 60 per cent of persons suffering from penetrating wounds of the eye were unable to resume their occupations.

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<sup>1</sup> A training lecture given on June 27, 1939, at Abbassia, to Officers of the Royal Army Medical Corps and the Egyptian Army Medical Corps.

The problem has therefore to be faced in Abbassia.

Of the remaining causes of blindness, I would draw your attention, as a matter of interest, to two other prolific causes, also mentioned in the report:—

(a) *Children's Injuries.*

In the United States of America, on Independence Day, there were 7,000 casualties due to fireworks. From these resulted 24 deaths and 550 wounds to the eye leading to 57 cases of blindness.

(b) *Traffic Accidents.*

The frequency of these necessitates special attention being paid to the universal fitting of safety glass and the systematic examination of the visual acuity and judgment of all automobile drivers.

In the Abbassia workshops the principal causes of metallic foreign bodies entering the eye are hammering, chipping, filing, emery-wheel grinding, turning, soldering, welding, riveting, and all forms of iron working. In addition, attention should be focused on the following points: (i) Fatigue and inattention to detail lead to injury; (ii) deficient lighting leads to injury; (iii) the workman's soiled fingers attempt to remove the foreign body and carry infection into the eye.

The report of the Association advocated the following outlines of first-aid as a prophylaxis: (a) Wash out the eye; (b) do not attempt to extract the foreign body; (c) cover the injured eye with a pad to prevent further infection; (d) send to an ophthalmic surgeon and not to a general practitioner.

In addition it states that: (i) The wearing of goggles, though not providing 100 per cent. safety, is the measure providing maximum protection up to date; (ii) the minimum of lighting for each workman should be 25 lux; (iii) there must be good ventilation and evacuation of acid fumes. With regard to this—last year some eleven R.A.O.C. employees reported sick with catarrhal conjunctivitis. This was chemical in origin, being regarded, by analogy with artificial-silk workers' conjunctivitis, as being due to the acid impurities of commercial paraffin, used in the spray for cleansing engine parts. Ventilation was improved; goggles and bland lotions advised, with the result that the patients recovered very quickly and that to date there has been no recurrence; (iv) there must be good fly-control; (v) trachomatous workmen should be excluded as they run the highest ophthalmic risk on sustaining intra-ocular foreign bodies. Egyptian Ophthalmic Hospital Reports state that 99 per cent of school children in Egypt suffer from trachoma. Personal examination of workmen prior to engagement has led one to observe that 80 per cent show the past or present stigmata of trachoma. Thus it is not feasible to exclude trachomatous subjects from the 2,000 Egyptians employed in Abbassia.

Attempts have been made to impress the need for carefulness on all ranks, and though there has been a diminution of some 45 per cent. on previous years, there are still one hundred cases of ocular foreign bodies yearly.

This diminution is, I regret to say, more due to the fact that several staff-serjeants and foremen have sustained bad injuries themselves than because of our constant admonitions. Also, there are still a few plague-spots left in the garrison. Two dry emery wheels which spray foreign bodies indiscriminately all over the workshop; the keen candidates of driver-mechanic courses, who practically apply their eyes to the metal when filing; and of course there is always the lunatic who looks up the exhaust pipe of the car which his friend is in the process of "revving up."

#### B.—THE OPHTHALMIAS.

There are the purulent conjunctivitis cases which in Egypt rapidly assume epidemic proportions at the beginning and end of the hot weather. Purulent conjunctivitis and trachoma are responsible for 80 per cent of Egyptian blindness. They have always been an Egyptian problem, since the days when Moses associated the twin plagues of flies and darkness.

The Napoleonic Army in Egypt, and the British troops that followed on, suffered an enormous incidence of ophthalmia, which most unhappily became known as military trachoma. The subsequent peregrinations of the French Army spread the ophthalmias throughout Europe.

In the Moorfields Hospital Museum there is a most interesting cutting from *The Times* of 1803, in which a Member of Parliament stated that though he had the greatest respect for the Army physicians, he was certain that the disease was not "trachoma." This view-point still holds.

The rapidity of spread, the descriptions of the course of the disease, the resultant destruction of many eyes, all point to the "trachoma" being an ophthalmia of gonococcal origin, spread by flies.

A recent Egyptian Ophthalmic Hospitals' report shows that the incidence of the ophthalmias coincides with the fly-breeding seasons and the dusty Khamseen or Haboob periods.

Koch-Weeks ophthalmia—of which we had a slight epidemic amongst our newly arrived military families last April and May—does not assume epidemic proportions till the mean maximum temperature is 25° or 26° C. On the other hand, gonorrhœal ophthalmia does not become epidemic till the mean maximum temperature is 32° to 35° C. Thus in the first fly-breeding season the Koch-Weeks ophthalmia is the most common, whilst in the second fly-breeding season—the autumnal one—the gonorrhœal ophthalmia is more prevalent. These statements are corroborated by the fact that Upper Egypt (the hotter parts of Egypt) provides more gonorrhœal ophthalmia, whilst Lower Egypt (the cooler parts of Egypt) provides the Koch-Weeks ophthalmias.

The "History of the Medical Services in the War" gives a description of the ophthalmias in the Turkish Prisoners-of-War Camp in Egypt in 1918. In the spring, very few eyes required enucleation. In the autumn, in the second fly-breeding season, of some two hundred eyes that had to be enucleated, the pathological reports showed the origin to be 90 per cent

gonococcal, aggravated, the book goes on to say (in a particularly pungent foot-note), by the criminal habit of tying up any discharging eye.

This habit, I may add, still has its devotees, and by its practice leads to the destruction of the eye from the pressure of the pent-up pus.

All the above description may at first sight seem to be a digression from the ophthalmic problems of mechanization. Mechanization, however, has made it possible greatly to increase the number of the forces capable of operating in the desert. The resultant congestion in the oases, or in long-standing camps, will provide the optimum "soil" for the ophthalmias—and the inevitable breeding of man's most persistent enemy, the Egyptian fly, will aid the dissemination of these diseases. Other methods of spread may well be due to partially dried infective material being thrown by the tracks of the preceding vehicle into the eyes of the driver of the vehicle next in station.

#### C.—THE HETEROPHORIAS.

In these diseases the visual axes of the eyes at rest assume abnormal positions. The requirements of normal binocular vision demand a suitable readjustment before clear vision can be obtained, thus giving rise to muscle strain.

Analysis of cases shows that though exophoria and esophoria are very common, yet deviations of up to  $10^{\circ}$  can be present without producing strain.

In exophoria the eyes turn outwards at rest; in esophoria the eyes turn in.

In hyperphoria the eye goes up and in hypophoria the eye goes down, though this latter term is not much used, the other eye being regarded as relatively hyperphoric. Of necessity, even slight degrees of hyperphoria give extreme discomfort, due to the necessarily complex readjustment required from the abnormal primary position of one superior rectus and inferior oblique, combined with the overaction of the other inferior rectus and superior oblique.

In an aeroplane flight, once contact with the ground is lost, all verticals are fore-shortened. Similarly it may be argued that in a motor-car at speed, though there be contact with the ground, the judgment of horizontals will of necessity be impaired, and ocular convergence will act under strain. Normally the eyes of a M.T. driver are fixed at infinity, and any error of the nature of heterophoria, by virtue of the abnormal primary position of the visual axes, may upset the power of accurate convergence upon the rapid approach of any object near to him. From this it may be hypothesized—all other things being equal—that the factors that lead to accidents are: (1) Slow mental reaction; (2) abnormal ocular primary positions; (3) deficient ocular muscle power.

Abrahams, in 1937, showed that a high percentage of cases of convergence insufficiency have an abnormal basal metabolic rate.

This evidence of endocrine imbalance may well link the ocular and mental aberrations.

The analogy to the air-pilot can be carried still further. The exophoric, whose eyes deviate outwards, on landing tends to judge the ground nearer to him than it really is and flattens out too soon—"dropping his ship on the deck." Thus the exophoric M.T. driver will be the man who "parks" badly and brakes suddenly and unnecessarily.

The esophoric whose eyes swing in too far flies his aircraft into the ground and runs his automobile into the backs of other vehicles.

Of course there are other "effective faults," those of poor neuro-muscular co-ordination. Always, however, differentiate sharply between the man of good eyesight but of poor technical performance, i.e. the "ham-handed" and the man who makes up for the disability of poor visual acuity by an excellent technical performance.

The retention of the faculty of convergence at near ranges shows that the individual holds a power of reserve of co-ordination and a capacity to resist fatigue, while on the other hand the loss of this faculty shows the lack of such reserve and a predisposition to fatigue (Parsons).

In addition to the heterophorias, visual acuity, colour blindness, night blindness, and hypermetropia (which through glare and the resultant spasm of accommodation causes judgment defects) all play their part.

Recently Krakov has shown that auditory stimulation, e.g. engine roar, depresses visual acuity; whilst augmenting the colour vision of blue and green, it at the same time diminishes the sensation of red. A point for the makers of traffic lights to consider.

The tests for heterophoria in general use are: (1) Those with dissimilar objects; (2) those with similar objects.

(1) *With Dissimilar Objects*.—(a) Red-green test; (b) Maddox red test; (c) cover test; (d) Bishop Harman test (progressive diminution of binocular fields).

(2) *With Similar Objects*.—(a) Simple convergence test; (b) Livingston binocular gauge.

Recently, the officers commanding two regiments permitted the examination of fifty drivers — including their best and their worst — in an attempt to estimate their capabilities. The above tests were done, with the sole exception that the Worth amblyoscope (plane-fusion) test replaced the red-green test. Rough allowance for mental index, but with no basal metabolic rate estimations performed, gave results which on tabulation corresponded very well to the driver's actual performance.

Such numbers are, however, too few to base conclusions on, the subjects being first-line troops with little abnormality of visual acuity.

More subjects will have to be examined of both the L. of C. and M.T. classes before it can be definitely established that a certain degree of heterophoria can be used to divide drivers into "the sheep" and "the goats," and that the use of this standard will eliminate the man who causes accidents, and so save the taxpayer's pocket.

## D.—OPHTHALMOLOGY IN WAR.

The main ophthalmic injuries in the field are those from metallic foreign bodies penetrating the eye. Only 50 per cent of these foreign bodies are magnetic, others (non-metallic) being sand from the destruction of sand-bags, cordite, etc. Commonly, traumatic rupture of the globe is due to a concussion air-wave following the passage of missiles close to the eye. Penetrating bayonet wounds are a rarity.

The "History of the Medical Services in the Great War" states that an immense saving of man-power was obtained by the immediate hospitalization of all acute "eye cases," and their subsequent discharge to a convalescent camp where there was an ophthalmic medical inspection room for observation before their return to the line.

The essentials of the ophthalmic service were: (a) Special out-patient rooms; (b) special ophthalmic wards; (c) specially trained nurses, orderlies and opticians; (d) special red labels attached to the ophthalmic cases at the casualty clearing station to facilitate their evacuation to the ophthalmic centre.

These ophthalmic centres were (1) *Base Ophthalmic Centre* at the Base Hospital, where the majority of the ophthalmic operations were done. The Centre contained: (a) Out-patient room, (b) operating theatre, (c) giant magnet, (d) wards for "gas" cases, (e) X-ray apparatus—for localization of foreign bodies, (f) pathological department.

The Centre was staffed by ophthalmic surgeons and ophthalmic nursing orderlies.

(2) *Advanced Ophthalmic Centre*.—Somewhat less elaborate than the above, having an optician in addition to the ophthalmic nursing staff. One of these advanced ophthalmic centres was attached to each army.

A "mobile magnet-car" was evolved, with a Haab magnet electrified off the dynamo of the car. In the body of the car was also an operating table. These cars were used in addition to the advanced ophthalmic centres. Towards the end of 1918, Professor Smith invented a portable magnet to be issued on the scale of one to each army.

In peace-time, however, such equipment is not available, and magnetic foreign bodies have to be dealt with through the co-operation of the Civilian Ophthalmic Services.

Before giving the figures to show the results of the ophthalmic service, attention may be directed to the Franco-Prussian War of 1870. In that war two out of every three casualties with ophthalmic wounds lost the sight of both eyes through sympathetic ophthalmia.

The "History of the Medical Services," in summing up the situation, states: (1) The majority of casualties with ophthalmic penetrating wounds retained their sight. (2) Nearly all cases with foreign bodies in the anterior chamber retained their sight. (3) Sympathetic ophthalmia was infinitesimal.

A note on the "gas" cases states that it should be clearly understood that cocaine given for the object of relieving the immediate pain leads in the end to greater destruction of ocular tissues than that from "gas" alone.

The records of ophthalmic cases in Egypt and Palestine amongst the British and Dominion troops shows that out of some 33,000 cases : (1) 17,000 were "refractions" ; (2) 3,000 were "conjunctivitis" ; (3) 600 only were "gunshot wounds" ; (4) 342 "trachoma" cases amongst Dominion troops were "chronic," and were held to have been acquired in Australasia, where the disease is endemic.

Unfortunately the medical records of the Western Desert Campaign against the Senussi—the first example of mechanized warfare in this country—are not available. They would be of great ophthalmological value.

For future desert warfare in Egypt one would suggest base ophthalmic centres in Alexandria and Cairo, an advanced ophthalmic centre should be situated at the casualty clearing station, and a mobile magnet car work round the oases.

The main problem of the Egyptian Army Medical Services would be their ever-present one of actual trachoma. An estimate of 80 per cent of affected recruits is conservative. As in the case of the Turkish prisoners of war in 1918, prisoners of war would provide a similar problem, which could only be dealt with by routine irrigation and the methods as carried out by the R.A.M.C. with the Labour Corps (*H. of M.S., Hygiene*, vol. iii).

In Egypt there are some sixty of the excellent *hopitaux ambulants aux tentes* of the Ophthalmic Section of the Ministry of Public Health. Each of these, with its staff of three medical officers and thirteen orderlies, treats some 60,000 patients a year. One might well be opened near a base hospital and others near each large recruiting centre.

Trachoma with European troops need not be regarded as a major problem. The relatively few cases in Egypt during the Great War are held to have contracted their disease elsewhere.

The many weighty authorities do not, it is to be regretted, much advance our knowledge for the prevention of this disease. Some differentiate by the presence or absence of Halberstaedler-Prowascek bodies between paratrachoma and trachoma. Others differ over the method of transmission of the disease, either by flies or by the louse of the eyebrows (rickettsioid disease). With one's little experience of trachoma amongst British troops one may with temerity advance the theory that there is a predisposing lowering of resistance, possibly of the food-vitamin deficiency type. In all cases, however, as by definition, trachoma is a chronic conjunctivitis, eyes with purulent discharges should not be sent in under the diagnosis "trachoma." The cause is generally one of the acute ophthalmias as described above.

To sum up, it is to be hoped that attention to the above problems may be repaid with the diminution in number of the eyes requiring enucleation, both in peace-time and in war.

The loss of one eye may bring the sufferer a 50 per cent disability pension, but this can be no real solace for the upset of the whole tenor of his life, nor an advantage to the state in the loss of his worth, both as a citizen and a soldier.



## Editorial.

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### THE ANNUAL REPORT OF THE CHIEF MEDICAL OFFICER FOR THE YEAR 1938.

THIS Report commences with philosophical and historical reflections on the real nature of progress in relation to public health. The Report was written before the outbreak of war and Sir Arthur MacNalty writes that under the black clouds of a national emergency much of the work of the Ministry has had to be devoted to medical emergency services, hospital provision for civilian air-raid casualties, and arrangements for the evacuation from urban centres and reception in other areas of school children and others.

The Report is a record of public health progress. Not only have the existing health services been maintained and developed, but a new health service, the cancer service, had been established by the Cancer Act of 1939. The work has been done in circumstances of unprecedented pressure.

The Second Section of the Report deals with vital statistics. The population of Great Britain, as enumerated at the census in April, 1931, was 44,795,357. Of this total 39,952,377 represented the population of England and Wales. The estimated mid-year population in 1938 of England and Wales was 41,215,000 (males 19,792,000, females 21,423,000). The rise in the average age of the population, to which reference has been made in previous Reports, has continued.

The birth-rate was 15·1, which is a slight improvement on the rate of 14·9 for 1937. The infant mortality has declined from 58 to 53 and is now the lowest on record. The crude death-rate in 1938 was 11·6 per 1,000 persons compared with 12·4 in 1937 and 12·1 in 1936. The standardized death-rate was 8·5 per 1,000 persons. The five principal causes of death at all ages were : Diseases of the heart and circulatory system, 327 per 1,000 deaths ; cancer, 143 deaths per 1,000 ; bronchitis, pneumonia, and other respiratory diseases, 91 ; diseases of the nervous system, 81 ; all forms of tuberculosis, 55 deaths per 1,000 persons.

If the causes are set out in order of magnitude for man's working life period, 15-65, tuberculosis takes the third place, then come bronchitis, etc., and diseases of the nervous system. Compared with ten years ago the proportion of deaths from diseases of the heart and circulation has increased by 98, and that of cancer by 21. The causes of the increase are complex, but one factor is the growing proportion of older persons in the population.

The third section of the Report is devoted to General Epidemiology. In the Introduction the risks which patients run when they are housed together are stated to be a commonplace of medical experience. Cross

infection in the treatment of scarlet fever in isolation hospitals is a conspicuous example of this, and the work of Griffith, Alison Brown and others goes far to explain it, and indicates the remedy. Similarly, McLeod and his co-workers, by their classification of diphtheria into *mitis* and *gravis* strains of *Corynebacterium diphtheria*, have paved the way to a reclassification of diphtheria patients in hospital. In maternity hospitals Colebrook and Griffith have demonstrated the dangers which may arise in the day-to-day work of these institutions.

Sporadic cases and small outbreaks of diarrhoea with a high fatality frequently occur in children's wards, and a good deal of work on the subject has been carried out in this country and in America. It is hoped that some method of differentiating between metabolic disorders and the infective processes, which give rise to similar symptoms, will evolve.

In 1938, 18 cases of smallpox were notified. Nine were of the major variety; four of these, one fatal, were notified in the Borough of Gravesend between the end of March and the beginning of June. At the beginning of March a patient suffering from major smallpox, acquired in India, was landed at the Port of London Isolation Hospital, Denton, near Gravesend, where the illness proved fatal in four days. This case was associated with the occurrence in contacts of an unusual illness resembling the toxæmia of smallpox. The first of the four smallpox cases subsequently notified in Gravesend was taken ill ten days after the imported case was landed, but no direct connexion between them could be discovered. Fatal illnesses suggestive of toxic smallpox occurred in the families of two other cases later notified in Gravesend, but no evidence could be obtained of any direct or indirect connexion between the three families concerned.

Eight cases of acute nervous disorder following vaccination were reported in 1938. Six of the eight cases were examples of primary vaccination in adolescents or young adults, and supply additional evidence for the warning repeatedly given that primary vaccination of children of school age and adolescents is to be deprecated.

There were 99,278 notifications of scarlet fever with a fatality of only 0.36 per cent. The large incidence of this disease continues practically undiminished. Owing to the risks of cross infection in isolation hospitals the indiscriminate removal from their homes of patients is likely to increase the incidence of streptococcal infections.

The deaths from measles and German measles numbered 1,641, being one-third higher than in 1937 and the third lowest in the past ten years. Covenery, Dixon and Harries examined a number of measles patients after they had recovered from the disease. They found that every case of bronchopneumonia complicating measles showed changes (infiltration, increased hilar shadows) which are greater than is usually supposed, and recommend that these children should be kept under examination at a clinic, preferably a tuberculosis clinic as facilities for radiological re-examination are essential.

The occurrence of jaundice after the administration of convalescent

measles serum has been investigated, but no clue to the cause of this has been elicited.

In 1938, 65,008 cases of diphtheria were notified. The fatality rate was 4·5 per cent, and 5·3 per cent in 1937 and 1936 respectively. Wright has pointed out that the fatality rate varies at different times and in different places, and this may be associated with varying type incidence. It was not until 1930-1 that the distinction between *gravis* and *mitis* forms of the diphtheria organism was made plain, and the distinction between these strains as a possible factor in the diphtheria incidence of various towns has to be taken into consideration.

Artificial immunization against diphtheria proceeds very slowly, and a Committee of the Medical Research Council has set up a subcommittee which is actively engaged in promoting diphtheria immunization. Artificial immunization against diphtheria became compulsory on April 15, 1937, in the Island of Guernsey.

The number of notifications of enteric fever (typhoid and paratyphoid) was 1,322 with 163 deaths, giving a fatality rate of 12·3 per cent. A special Section of the Report (IV) is devoted to the enteric group of fevers. Diagnosis and the usual tests—blood culture, plating of fæces and urine, agglutination reactions, etc.—are described. Marres' test is stated to be of value where laboratory aid is not available. The test depends on the fact that atropine does not accelerate the pulse at certain stages of active typhoid infection to the same extent as in normal individuals or those affected by other fevers. It has been found most useful between the fifth and fourteenth days. An acceleration of 14 beats per minute is taken as the upper limit. If it be 15 or more the reaction is negative.

Short accounts of five outbreaks in 1938 are also given illustrating the various ways in which carriers or missed cases infect foodstuffs.

In 1938 there were 4,847 deaths from influenza, so it cannot be considered to have been an epidemic year. In the ten years after the pandemic of 1919 there was an almost regular alternation of epidemic and non-epidemic years. In 1931 a change came and three years of epidemicity were followed by three years of moderate prevalence.

A large proportion of influenza deaths occurs usually in the first quarter of the year. The number of influenza deaths continued to rise until February, 1939, thereafter declining. The increased prevalence was irregular in distribution and in some communities a substantial portion of the morbidity was regarded as being due to febrile respiratory catarrh and not to influenza. Tests were made in the early days of recrudescence in the first quarter of 1939, but no virus comparable to that secured in previous epidemics was recovered. It is stated that the presumption is that there are other infections which may be clinically indistinguishable from that of the known influenza virus and in which the ætiological agent remains unidentified.

An outbreak in 1939 was studied by Dr. C. H. Stuart-Harris at the

National Institute. The known virus seems to have played a subordinate part ; it was several weeks before the virus could be discovered in connexion with this outbreak. The symptoms were very varied and the virus could not be related to any definite clinical picture.

There is a very full account of poliomyelitis and polio-encephalitis during 1938, which is the peak year since notification became compulsory in 1912. Unfortunately the number of notifications does not represent the actual prevalence as many mild and abortive cases are not notified. The history and prevalence of the disease since 1926 are fully described.

Section V of the Report is devoted to the Emergency Hospital Organization and Medical Arrangements in connexion with civilian evacuation. The subject of emergency hospital accommodation for air-raid casualties is considered to be very difficult as there are no precedents or experience to guide us. In this chapter of the Report only an outline is given, and for further details reference is made to the comprehensive White Paper presented to Parliament by the Minister of Health and the Secretary of State for Scotland.

By the provision of the Civil Defence Act, 1939, the Minister of Health and the Secretary of State for Scotland are responsible for securing that in the event of war, facilities will be available for the treatment of casualties occurring in Great Britain from hostile attack.

A regional organization in time of war is required as communications might be temporarily severed with the central seat of government. The Government has therefore divided England into ten regions, each of which is in charge of a Civil Commission.

A special department of the Ministry has been set up to deal with air-raid precautions, and Dr. J. H. Hebb appointed Director-General of Emergency Medical Services to direct and organize hospital services. In each region there are one or more hospital officers concerned with the Ministry's central scheme for accommodation for air-raid casualties. Liaison with local authority hospitals is effected through the medical officers of health of counties and county boroughs.

It was necessary to organize the voluntary hospitals of the Region. London presented special problems and accordingly the Region was divided into 10 sectors each radiating from an apex in the centre out into the home counties. Nine of the sectors were based on one or more of the teaching hospitals, while the tenth was based on the large hospitals in East Ham, West Ham, Romford, Stratford, and Ilford. At their wide ends the sectors extended beyond the boundaries of the Metropolitan Police District into Essex, Hertfordshire, Buckinghamshire, Berkshire, Surrey, and Kent.

A group officer, the Dean, or other senior member of the medical staffs of the teaching hospitals, was appointed for each of the ten sectors and has worked out the plan of the Ministry. In the London Region a lay sector officer and a sector matron were appointed for each sector, the first to

organize non-medical matters involved in the dispersal of hospitals and the second to plan the distribution of the nursing staff. In war each group officer would be responsible for directing the movements both of casualties and of personnel in his own sector, but the hospital officers would be responsible for co-ordinating the operation of the emergency scheme over the whole region.

The problem in the provinces was different from that of London, and it was not considered necessary to divide any other towns into sectors in England and Wales. The hospital officers, however, arranged to affiliate a number of the hospitals and institutions outside the larger towns in England and Wales to the inner hospitals, and group officers were appointed for these affiliation schemes in 18 towns. As in London, the group officers were responsible for the organization of the medical personnel in the affiliated hospitals.

An important principle was that there was to be no interference by the departments in the internal administration of any hospital. The Government would decide which hospitals were to receive casualties and would equip them for the work allotted to them. The hospitals would be responsible for the treatment of patients, as in peace-time, and many of their patients, even in the danger area, would be the ordinary civilian sick. The organization of the hospitals in the casualty scheme was entirely different from that of the Territorial Army hospitals, which exist for one class of patient only and under one control. In the emergency scheme are included voluntary hospitals with a long tradition of independence, and municipal hospitals with their own efficient organization. The Departments have respected the integrity of both while combining them into a homogeneous whole. It was considered important to appreciate the essential differences between the military and civilian schemes.

It was considered that in the case of war 300,000 hospital beds should be made available for civilian casualties at the earliest possible moment, and account must be taken of the needs of the fighting services. The Health Departments have worked in close collaboration with the three fighting Services Departments and it has been arranged that the immediate requirements of the latter shall be met out of the civilian hospital pool in so far as they are not provided for by the embodiment of a certain number of Territorial Army hospitals in buildings not normally used as hospitals. The Service requirements were expected to increase after the first few months of war, but it was anticipated that it should then be possible to provide them with additional accommodation either by releasing beds from civil casualty work or by the provision of new hospitals.

The methods to be adopted for providing immediate casualty accommodation were: (1) All ambulant patients and those capable of being discharged were to be sent home. It was estimated that this would free 100,000 beds. (2) By introducing extra beds. This with beds in mental hospitals should give 150,000 extra beds. (3) Accommodation in new

huttet hospitals and new huttet wards. By this means 40,000 additional beds would be provided. (4) Building new hospitals by local authorities where they are required as part of the peace-time organization.

The problem of shifting base had to be considered. London is a striking instance of this problem. The big teaching hospitals were to be evacuated of practically all their patients and to serve as casualty hospitals. Motor buses fitted up as ambulances would convey the patients out of London to more distant hospitals. It was anticipated that there would be a steady flow of patients along the radiating lines of the sector system to subsidiary hospitals. In this way convalescent casualties would end up at a distant hospital in a more remote part of England or Wales.

Interchange of hospital accommodation was also considered. An area A might be heavily bombed and its hospital accommodation severely strained, while an area B with ample unoccupied beds might be untouched. Arrangements would be in force for B to receive the surplus casualties of A.

The basis of the scheme which has been worked out by the two departments is that casualties should not be retained in hospitals in the most populous areas for longer than can be avoided, and accordingly efforts have been concentrated on increasing the hospital accommodation in the relatively safer areas and providing adequate transport. None of the hospitals in the danger areas can be abandoned as they will need to be used both as receiving stations for casualties and as hospitals for ordinary sick in urgent need of treatment. In the inner areas of London it is proposed, if possible, substantially to reduce the number of beds in occupation in order that the staff may be freed to serve the beds in the outer areas, and it is hoped that it may be practicable to move casualties out within a few hours of their reception. In other English towns there are not enough existing beds to make it practicable to contemplate reduction, and the Ministry have avoided increasing the number of beds in the inner areas on the assumption that casualties will be immediately evacuated. In Birmingham and Newcastle it was considered that it would not be safe to rely on the existing number of beds and they have been increased.

Every hospital and institution considered capable of treating casualties and convalescent cases has been included in the scheme with the exception of infectious diseases hospitals and maternity units in areas scheduled to receive evacuated children. All the hospitals have been divided into two classes: Class 1 being hospitals which are capable of doing surgical work and have been allocated for the reception and treatment of casualties, Class 2 hospitals being those which will undertake convalescent and medical work. Every hospital has been informed of the class in which it is placed, of the number of beds which it is expected to accommodate and of the number it is expected to clear on receiving warning. For working purposes within the departments Class 1 hospitals in the areas which are being evacuated are regarded as casualty receiving hospitals, whilst those in neutral or reception areas are regarded as advanced base or base hospitals.

Mental hospitals play an important part in the emergency scheme. It is not proposed to send home mental patients on the outbreak of war, but the Board of Control has estimated that in emergency the existing beds in mental hospitals could be increased by 25 per cent without injury to the patients. Detailed proposals have been made by the medical superintendent of every hospital; the majority are able to take extra beds. This has been done by re-arranging the patients' accommodation and thus setting free one block for casualties. In a few cases mental patients would be transferred to other hospitals and the cleared hospitals converted into base hospitals. This has been done at Horton, Epsom (2,500 beds), Hill End, Hertfordshire (1,400 beds), and the Park Prewett, Basingstoke (2,000 beds). These three will be base hospitals for London. There are very few general hospitals in being in rural or semi-rural areas where base hospitals must be located. Accordingly, in addition to the mental hospitals, public assistance institutions, sanatoria, and one or two miscellaneous buildings (such as the Royal Blind School at Leatherhead) are being designated as base hospitals. None of these institutions are normally capable of undertaking acute surgical work and they are to be "up-graded" to Class 1 status by the provision of the necessary equipment. This includes operating theatres, X-ray rooms, dark rooms, etc. Arrangements have been made for up-grading 156 hospitals and institutions in England and Wales.

The provision of first-aid posts is the responsibility of local authorities, who are charged with the duty by the Air Raid Precautions Act of 1937. Responsibility for approving such schemes was transferred to the Ministry from the Home Office in December, 1938.

In every Region there will be a certain number of first-aid posts, generally supervised by the medical officer of health and under the control of a medical practitioner who will be remunerated by the Government for his services. It is considered undesirable to bring contaminated but unwounded casualties into aid posts which are situated in hospital premises. Local authorities are meeting this either by providing cleansing stations in public baths or other suitable buildings, or by erecting decontaminating stations in the grounds of hospitals. The doctors in first-aid posts will generally be part-time officers and the staff will consist of volunteers. The posts will generally be in existing medically equipped buildings not required for use as hospitals, at out-patient departments and health clinics.

The supply of medical personnel for hospitals, first-aid posts, and generally for the allocation of medical men to appropriate posts in time of war was arranged for by a Central Emergency Committee formed by the British Medical Association, which asked all the medical practitioners in Great Britain to register with it on a voluntary basis for a national emergency. The response was general, and doctors were classified into their appropriate services, so many for the Army, so many for the Navy, so many for the Air Force, so many for specialist services, so many for hospitals, so many to continue in official posts or in general practice. The British Medical

Association devised a scheme whereby a man's practice will be carried on during his absence on war work by another practitioner and kept intact for him, as far as possible.

In London the Royal College of Physicians and the Royal College of Surgeons have set up a Committee of Reference for the staffs of London hospitals in the same way. For additional hospital officers the Government will call up the doctors they require from these committees and will pay them at rates corresponding to R.A.M.C. ranks—Colonel, Major, and Captain.

A sufficient number of practitioners has been selected to staff 200 medical boards estimated to be required in the event of an extended measure of conscription, and about 150 of these boards are now being used for the purposes of the Military Training Act.

In connexion with the difficult task on air-raid precautions the Ministry have obtained the advice of the leaders of the medical profession through its Medical Advisory Committee, which is permanent and can be consulted on all forms of health projects.

On the advice of the Presidents of the three Royal Colleges, consulting experts have been appointed by the Ministry in medicine, surgery, orthopædics, jaw and face injuries, dentistry, neurology, and psychotherapeutics.

The Medical Research Council have been made responsible for the laboratory organization in the country required in time of war. The Ministry have linked up this work with the public health and hospital regional organization, and with the work of county and municipal laboratories.

At the end of Section V there is a note which states : " Since this chapter was written war has been declared and the vast organization here described has come into being. Certain modifications and adjustments have had to be made, but on the whole it has stood the test of experience to a remarkable degree." The real test has yet to come.

There has been much criticism of the scheme in the medical papers. The scheme was devised to meet circumstances which, although thought to be inevitable, have not yet eventuated. In principle the emergency scheme was considered sound in detail, but in London it was thought to have defects in regard to existing boundaries and the number of beds available in the inner and outer zones owing to the alleged necessity to have a voluntary teaching hospital at the apex of each sector.

To those who were responsible for the medical arrangements in the Great War the relationship between the War Office and the Ministry of Health in the existing arrangements seems most important. The Secretary of State for War in his speech in Parliament said he did not regard the present position as altogether satisfactory, but it has to be borne in mind that the plans were made at a time when emphasis was laid on the bombing of towns and the civilian casualties which it was expected would result, rather than on land warfare and military casualties. Discussions were now being carried



on to ascertain whether it would not be possible, without abandoning the principle, to arrange that although hospitals should still be able to accommodate civilian casualties, more effective control could be established with regard to the number and the location of beds required for military cases.

In 1938 there was an increase in the notifications of cerebrospinal fever, and the Report states that the possibility we are approaching another period of epidemic prevalence cannot be disregarded. During the twelve months from April, 1938, to March 31, 1939, meningococci from 104 cases were examined at the Ministry's laboratory. Of these 71 per cent belonged to Group I and 29 per cent to Group II. Reference is made to the paper by Dr. Banks on the treatment of 113 cases of acute meningococcal meningitis with serum and sulphanilamide. The results were encouraging, and later reports were received on the treatment with M & B 693. The number of reports received is considered too small to draw dogmatic conclusions, but it is thought reasonable to suggest that a patient with cerebrospinal fever should be given a dose of one of the sulphanilamide products as soon as possible after diagnosis.

The rise in cerebrospinal fever in 1937 and in 1938 was not great, but its occurrence just before the outbreak of war caused some concern as to what would happen to young men now concentrated in barracks. Unfortunately there has been a great increase in cases of cerebrospinal meningitis during the present year. Active preventive measures and adequate treatment with sulphanilamide were early advocated by the War Office and a memorandum was issued by the Director-General. As a result, the case mortality has fallen from about 40 per cent to 6 or 7 per cent.

We have had to devote so much space to a description of the Emergency Hospital Organization that a consideration of the remaining sections of Sir Arthur MacNalty's Report will have to be deferred to another issue of the JOURNAL.



## Clinical and other Notes.

### DIEPPE MEDICAL SOCIETY.

Major W. M. Priest, R.A.M.C. showed a case for diagnosis.

Lance-Corporal A. S. slipped and injured both legs on the edge of a stone doorstep, on December 31, 1939.

The injuries were :—

(1) Laceration on the right shin one and a half inches long, extending into subcutaneous tissues only, the edges gaping about three-quarters of an inch. No abnormal bleeding.

(2) Large soft swelling just beneath the left patella, about four inches in diameter, fluctuant and painless except over the actual site of impact.

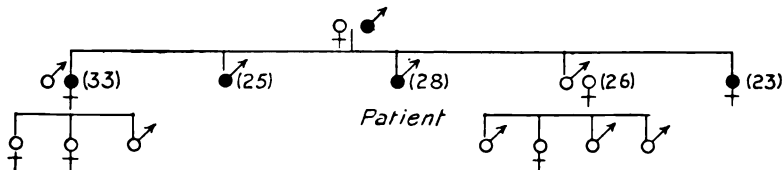
A note made six days later states that there were two large hæmatomata on the left leg, below the knee, from one of which a pint of blood-clot was evacuated. The other hæmatoma was present twelve days later, on admission to No. 10 General Hospital. This was about two and a half inches in diameter, and painless and soft.

Further examination revealed that the man's skin showed abnormal elasticity over the whole body, but most noticeably over the sternal area, where it could be pinched up, and pulled out painlessly for a distance of three or four inches or more.

In addition there is hypermobility of some of the joints, particularly the hips, legs being hyperflexible, so that the ankles can be made to touch the back of the neck.

*Previous History.*—The man states that he has from childhood been liable to get large swellings, similar to those present now, on relatively trivial injury, and that the elasticity of the skin has also been present as long as he can remember. He was unable to play games to any extent on account of these swellings. There is no history of excessive open hæmorrhage.

*Family History.*—The father and three blood-relations, of both sexes, are affected by the same combination of symptoms. Six children of both sexes in the third generation are unaffected.



*Further Notes.*—The blood-pressure, bleeding and coagulation times, thrombocyte count, and capillary resistance, were normal.

There was no abnormality in the nervous system.

There was a thin parchment-like rounded scar, about the size of half a crown, on the right leg at the site of a previous hæmatoma.

Colonel J. T. Ingram, Consulting Dermatologist, British Expeditionary Force, explained that this patient shows the features of the Ehlers-Danlos syndrome. In this syndrome one finds hyperelasticity of the skin, hyperextensibility of the joints, and a fragility of the blood-vessels which predisposes to the development of hæmatomata from slight trauma. These hæmatomata heal to leave characteristic papyraceous scars, usually about points of pressure and seen about the knees in this man.

The affection is often inherited and familial. In this instance the father, two brothers, and one sister of this man are affected.

Major M. B. Dick, R.A.M.C., presented two cases :—

(1) *Retroperitoneal hæmatoma* which had followed upon removal of an undescended testicle encountered during an operation for strangulated hernia. Convalescence had been disturbed by pain in the right flank and iliac fossa and more than ordinary flatulent distension. The temperature and pulse-rate were raised, and there was moderate anæmia. Three weeks after operation, when the man reached a hospital at the Base, there was a tense, slightly mobile swelling, which occupied the entire right flank, and extended forward to the costal margin, and below the iliac fossa.

There was considerable speculation as to the nature of the swelling. A small hæmatoma in the hernia wound offered a possible key to Colonel Max Page's belief that hæmorrhage from divided spermatic cord was responsible. This was confirmed by an exploratory incision through which two pints of chocolate-coloured fluid were evacuated from the flank. A growth of *B. coli* was obtained from the fluid. Recovery was prompt and uneventful.

(2) *Gangrenous abscess of the right lung*, which developed during an attack of tonsillitis. The early features were those of pneumonia. Retarded recovery prompted needle puncture of the pleura which yielded eight ounces of fœtid pus. Subsequent exploration by rib resection opened an empty pleural pocket. The illness was unabated, and not many days later the patient coughed up a large quantity of fœtid pus containing a mixed flora of mouth spirochaetes, streptococci, etc. Evidence of lung abscess was obvious from the physical and radiographic signs. Transfer to a more rural hospital was recommended and a natural resolution awaited. There was temporary improvement but the man's illness continued. The X-ray films revealed an abscess in the dorsal part of the lower lobe of the lung, high up. From time to time a fluid level was detected.

The abscess, superficially placed, was drained by resecting parts of two ribs. It contained dark-coloured thick pus of a foul odour. Recovery was slow but satisfactory, and the wound was practically healed at the end of seven weeks when the man was sent home.

Major G. Perkins, R.A.M.C., showed a number of patients, under treatment

for fractures of the limbs, walking. He emphasized the importance of preserving the function of the limb while the bone was repairing, and pointed out that splintage was often unnecessary.

Major J. S. Jeffrey, R.A.M.C., showed :—

(1) A case of hæmatocele and generalized bruising of the scrotum due to a blow during physical jerks.

(2) A case of burns which raised the question as to what method should be adopted in the primary treatment of burns when the case will have to be transferred later to hospital at a base. Treatment by any method of tanning, to be successful, must ensure that the area is kept aseptic, which is achieved normally by leaving the patient naked under a large shock cage. If the tan is covered by dressings and blankets, as is necessary during the journey to the Base, the burn almost invariably becomes septic. The value of tanning in burns under thirty-six hours is too great to warrant discarding that method of treatment, and it is suggested that the tan that will best tolerate coverings is one that is pliable and antiseptic, e.g. a weak solution of tannic acid, or 10 per cent. silver nitrate with alternate applications of one of the aniline dyes such as 1 per cent methyl rosaniline or gentian violet. Once the burn has become frankly septic the tan is best removed and the wounds dressed with an ointment of equal parts of lanoline, vaseline, and eucalyptus.

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## A CASE OF STRANGULATION INTO WALDEYER'S POUCH.

By LIEUTENANT-COLONEL R. COYTE,

*Royal Army Medical Corps.*

PILOT OFFICER C., aged 21, was admitted to Hatfield House Military Hospital with a diagnosis of chronic appendicitis.

*Previous History.*—The patient complained of attacks of pain in the right iliac fossa at intervals since childhood, particularly after violent exercise such as football and tennis. These attacks varied in severity, the pain was sometimes very acute and associated with vomiting. The pain never lasted longer than half an hour, and recently he was diagnosed by his medical officer as appendicular colic and recommended for appendicectomy.

He was admitted to this hospital on February 12, 1940. At that time he was slightly tender in the right iliac fossa on deep pressure, but had no tenderness *per rectum*. I considered him to be a case of chronic appendicitis, and arranged to do an appendicectomy on the morning of February 14. At 11 o'clock on the night of February 13 the patient was seized with violent abdominal pain, with vomiting and collapse. I saw him at 11.30 p.m. and found his abdomen only slightly rigid and distended, although at that time he was in great pain and vomiting constantly. I arranged to do a laparotomy at once on the assumption that he was one of the rare cases of fulminating appendicitis.

The patient was taken to the theatre and given a general anæsthetic. On arriving on the operating table a circumscribed swelling was seen to have formed rapidly in the right iliac fossa spreading upwards above the level of the umbilicus.

I made a Battle incision. The appendix was seen to be normal. I then discovered a large swelling lying behind the upper part of the cæcum and the lower part of the ascending colon. The latter was reflected inwards and immediately a large tumour of slightly bluish colour was observed. This appeared to be a sac containing fluid. I thought that it would prove to be a very large distension of the pelvis of the right kidney as a result of occlusion of the right ureter by a stone. Such a condition would have explained all the previous symptoms.

The surrounding tissues were carefully packed off and an incision made into the sac. There was an immediate escape of about five to six ounces of a thin purulent fluid, closely followed by coils of small intestine of a deep blue colour, indicating recent strangulation.

The condition was now certainly one of strangulation into an intra-peritoneal pouch, and by passing a finger inwards I could feel a tight constricting band at or about the level of the mid-abdominal line.

After reflecting the ascending colon laterally, the opening of the pouch was discovered with the superior mesenteric vessels stretched tightly over its anterior surface. The diagnosis of the rare condition of strangulation into a Waldeyer's or parieto-mesenteric pouch was at once established.

By stretching the opening, about four feet of mid-jejunum was soon returned to the general peritoneal cavity and the intestine rapidly resumed its normal colour. By this time the opening of the pouch was widely stretched and no repair operation was deemed necessary.

A tube was left in the pouch for forty-eight hours, because the fluid which escaped appeared to be turbid.

The patient had rather a stormy forty-eight hours and has since made an uninterrupted recovery.

The previous attacks of pain were clearly due to subacute obstruction which had always ended in spontaneous release.

It is worth mentioning that the late Lord Moynihan carefully described this condition and stressed its rarity.

I have to thank Colonel W. R. Ward, Officer Commanding the Hospital, for permission to send this case for publication.

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#### A USEFUL FORM FOR RECORDING CASUALTIES.

By COLONEL T. H. SCOTT, *D.S.O., M.C.*

DURING the War of 1914-18 and during battles, it was the habit of many General Officers Commanding to send round to field ambulance dressing stations to ask for the numbers of casualties admitted and also how certain of their units had suffered.

The form given here was designed by the author to give an accurate and very rapid calculation of both total casualties and those by units.

**SICK**

The division of the form into time periods is not necessary, but as the first hour shown was zero hour, it was very interesting to note how long after that hour the big rush of cases took place. The length of the time periods

has to be varied—the greater the number of expected casualties the shorter the periods, so that in some of the big battles two or more forms were required for the twenty-four hours.

The details in the legend may be amplified or altered, and if gas cases are expected in large numbers, one form could be used for them alone.

In the author's unit separate forms were always maintained for wounded and sick.

To aid in the rapid addition of the figures, every five were stroked off diagonally as they occurred.

As regards the names of units, it was always possible, before the actual battle, to enter in those of the brigade or brigades engaged, but blanks were left for cases from other units, which were filled in by the N.C.O. responsible for the form.

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## Echoes of the Past.

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### TWENTY YEARS AFTER.

BY H. SKIPTON STACY, M.D., Ch.M.(Syd.), F.R.A.C.S.

*Honorary Consulting Surgeon at Sydney Hospital, Ryde Hospital, and Royal South Sydney Hospital.*

(Continued from p. 304.)

CASE 23.—Suppuration of Both Knee-joints and of the Thighs.

*Clinical History.*—Nature of wound : Gunshot wound, limbs. (Shrapnel).

Signs and symptoms : Hit with shrapnel in both knees and the ankle. Has a compound fracture of the leg. Several fragments were recovered, but he was much too shocked to make a prolonged search. His mental condition suggested shell-shock ; he cried frequently, and was very noisy at times. Pus developed in both knee-joints ; they were opened and drained, but without improvement. Temperature during the last few days of life was normal and subnormal, pulse about 100.

Operation : Both knee-joints opened and drained.

Survival : Two weeks.

*Post-mortem Result.*—Limbs : There was pus throughout the left knee-joint ; it also extended up the femur for about two-thirds of its course, next the bone. Inside the joint, on the lateral aspect of the external condyle, was a small piece of shrapnel that had not been removed ; there was pus around it ; probably this had caused the infection of the joint. Right knee-joint : The shrapnel had taken away some of the medial tuberosity of the tibia on its upper surface, and then found its way into the posterior pouch of the joint behind the condylar notch. The joint was very red and inflamed, and contained pus. Pus also extended up the thigh but not so far as in the left limb.

Comment : Possibly removal of the foreign bodies from the knee-joints might have prevented infection, but as he was much shocked at the time of operation it was a very difficult problem.

CASE 26.—Gunshot Wound, Femur with Gas Gangrene.

*Clinical History.*—Nature of wound : Gunshot wound of thigh.

Signs and symptoms : Has a compound fracture of the left thigh about three inches above the knee. Wound of entrance on the inner side, and of exit on the outer. Had been kept in the field ambulance, owing to shock. Came round after operation ; quite conscious, dictated a letter home. At four o'clock next morning he appeared to get suddenly very ill ; sweating, pale, and collapsed. Died three hours later.

Operation : Wound explored ; popliteal artery and vein shot through ; leg below the knee was cold and becoming discoloured blue in patches. Leg amputated through the middle of the thigh (anterior and short posterior flaps). Tissues appear quite healthy at the site of amputation. Given intravenous saline and pituitrin.

Survival : About twenty-four hours.

*Post-mortem Result.*—Limbs : Examination of the amputated limb showed that the popliteal artery and vein had been completely shot away ; the vein was distended with dark thick blood down to its division into anterior and posterior tibial branches. Examination of the left thigh above the site of amputation showed that the adductors, sartorius and ham-string muscles were soft, mushy, toneless and spongy ; lighter in colour than normal. The quadriceps group were quite normal. The skin over the affected muscles was mottled, and the subcutaneous tissues discoloured brown. No definite emphysema except that pressure on the muscles caused gas to come out of the cut end of the muscles in the wound. This condition ended abruptly at Poupart's ligament in front ; behind, the gluteal muscles were quite healthy.

Pathological report : Muscle from the thigh exhibits a well-defined lesion of gas gangrene, with separation of fibres ; fairly early stage.

CASE 47.—Gunshot Wound, Femur with Gas Gangrene.

*Clinical History.*—Nature of wound : Gunshot wound, left hip.

Signs and symptoms : On admission, temperature normal, pulse 88. Next day temperature 100° F., pulse 94. Next day temperature 99·6° F., pulse 180. Next day temperature 101° F., pulse 120. On this day he complained of not feeling well, and looked very pale. Later the pulse became impalpable ; died rather suddenly during the night ; was conscious to the end.

Survival : About eighty-four hours.

*Post-mortem Result.*—Limbs : A septic-looking wound of the left hip involving the great trochanter ; a drainage tube was put in, but there had not been much discharge. Upper thigh swollen, also the gluteal region ; skin



bronzed. Incision showed the superficial tissues to be coffee-coloured and emphysematous; this condition extended down to the knee-joint; below that, the superficial fascia was healthy. The vastus externus was paler than normal, friable and emphysematous; the muscle-bundles were separated and had lost the bluish appearance of healthy muscles. The ham-string muscles were doubtful, but probably healthy. The glutei were badly involved. Abdominal and back muscles were normal; muscles of the leg normal. The wound extended right down to the tuber ischii, which, however, was unwounded. There were loose pieces of the great trochanter deep in the wound; these were obstructing drainage.

Bacteriological report: Films from subcutaneous tissue of the thigh showed large Gram-positive bacilli morphologically resembling *B. aerogenes capsulatus*, present in large numbers; also smaller Gram-negative bacilli. Tissue from the thigh muscle also gave a similar result.

#### COMMENTS MADE IN 1937 AFTER REVIEWING THE NOTES.

Several features stand out :—

(1) The absence of upper limb cases—due mainly to the larger muscle mass and larger blood-vessels of the lower limbs.

(2) The high incidence of gas gangrene in the fatal cases. This again, flourishing in muscle, naturally gained greater headway in the lower limbs.

(3) The tendency of gas gangrene to be confined to muscle groups, rather than extend around or throughout the limbs (unless, of course, the missile penetrated both flexor and extensor aspects). It would follow from this in theory, that removal of the affected group of muscles would be sufficient to eradicate the infection; in practice this would leave a limb of doubtful utility, but I can conceive cases in which this less-shock-productive operation might have saved life, where amputation lost it. Later on, when the patient was in better condition, amputation could follow.

(4) Gas infection, though most fatal and typical in muscle, also existed in the superficial fascia, to which it gave a brown appearance; the skin overlying it was coppery and emphysematous. The infection of the superficial fascia was sometimes confined to that; in other cases it was secondary to underlying muscle infection. The prognosis in the latter event was, of course, much more serious than in the former. To this day, surgeons are apt to get unnecessarily alarmed at gas in the superficial tissues and want to sacrifice the limb; they talk of gas gangrene without realizing the different forms gas infection may take.

(5) X-rays are occasionally helpful in demonstrating gas in the superficial and deep tissues. The No. 2 A.C.C.S. did some pioneer work in the field with their own equipment in 1916.

(6) It is difficult at times to be sure whether gangrene of the limb is due to gas gangrene, or due to wounding of the main vessel. Time, of course, helps in the decision, but if one delayed operation and it is a case of gas infection, the result is fatal.

(7) The supplying of the Thomas's splint to the advanced dressing stations (partly on the advice of the No. 2 A.C.C.S.) helped to reduce the mortality of gunshot wounds of the femur, inasmuch as the splint (slipped over the man's puttee and breeches), immobilized the limb early. As a result, this class of wounded came to the clearing stations much less shocked than before, and an operation for gas infection, etc., could be carried out with greater safety. The remarkable reduction in the mortality of gunshot wounds of the femur, from 80 per cent during the first year of the War down to 20 per cent in the last year, is a tribute to Sir Robert Jones for his constant advocacy of this splint.

(8) Infected wounds of the knee-joint were always an anxiety and frequently fatal. The infection tended to extend up the thigh next the bone.

(9) Pyogenic organisms were not infrequently present as well as the organisms of gas infection. Streptococci are said to add to the virulence of gas infection; staphylococci are said to diminish it. Here again the question arises whether prontosil or its allies would have any effect on such infections.

(10) Shock in these cases, as, in fact, in every class of wound, was the great enemy. I have dealt with its treatment under abdominal wounds.

Of the limb cases that were autopsied, gas gangrene was present in Nos. 47, 26, 22, and 19. The others died of: (a) Pyogenic infection originating in wounds of the knee-joint; (b) shock; (c) hæmorrhage.

In the gas gangrene cases, it is remarkable how many remained conscious to the end, going off rather unexpectedly suddenly. Pallor is another constant feature. The temperature was in some cases normal or slightly elevated to 101° F. or so, but the pulse was invariably rapid and feeble.

In the later stages of the War and in the years since then, gas gangrene serum has been used prophylactically and therapeutically. There are varying degrees of faith in its efficacy; I myself have been somewhat sceptical. I quote from Choyce's "Surgery": "The benefit derived from this serum was not sufficiently noticeable to justify any great enthusiasm."

But an article by Bates, in the *Annals of Surgery*, February, 1937, comes to these conclusions:—

(1) In a group of sixteen cases of gas gangrene treated without serum the mortality was 50 per cent. In a group of sixteen cases in which serum was an essential part of the treatment, the mortality was 18 per cent.

(2) Prophylactic antitoxin should be used in all wounds potentially infected by gas bacilli. The occasional case which develops gas gangrene, despite prophylactic serum, does not prove its inefficiency, but does suggest that an increase in prophylactic dosage, or an early repetition of the injection, may be advisable.

(3) Prophylactic serum should be given pre-operatively to patients who are to undergo amputation for diabetic or arteriosclerotic gangrene.

The *B. aerogenes capsulatus* is the infecting organism in quite 80 per cent of cases, and the antitoxin of organisations such as Burroughs Wellcome, the Australian Commonwealth Laboratories, and Parke, Davis and Co.,

provides for that toxin alone; but the last firm, in addition, put up a combined antitoxin providing against both the *B. aerogenes capsulatus* and the vibrión septique.

Just recently Penfold and Tolhurst, in the *Medical Journal of Australia*, June 26, 1937, in an article under the title of "Formol Toxoids in the Prophylaxis of Gas Gangrene," make the following statement:—

(1) Formol toxoids of *B. welchii* which have been rendered atoxic for mice in 1 c.c. quantities intraperitoneally, produce effective immunity in animals when given in from four to eight large injections.

(2) Suspensions of alum precipitates of similar formol toxoid given in two small injections a month apart, are excellent immunizing agents in animals. Both active and passive immunity have been demonstrated. Our animal experiments suggest that the prophylaxis of gas gangrene in man by the use of formol toxoid is a feasible proposition.

If, as Winston Churchill said in a recent contribution to the Press, war is coming nearer, "inch by inch, week by week," then I trust something may result from their work, particularly if the war is to be fought on soil at all resembling that of Flanders.

The following cases were seen after the comments had been written:—

#### CASE 64.—Hæmothorax and Pneumonia.

*Clinical History.*—Nature of wound: Gunshot wound, back.

Signs and symptoms: Hit in the back—lumbar region, near the mid-line, just to the left; was stooping at the time. The following day was aspirated; about ten ounces of dark blood withdrawn; bacteriological examination of both smear and culture was negative. Next day twenty-one ounces more withdrawn. In spite of this did not improve and died several days later; remained very pale and was very dyspnœic. Temperature 102° F. on the second day, then down to 100° F.; after that normal and subnormal.

X-ray report: On the day of admission showed a left-sided hæmothorax.

Operation: The abdomen was opened several hours after admission but no lesion was found.

Survival: Four or five days.

*Post-mortem Result.*—Chest: In the tenth interspace, about one and a half inches to the left of the spine, there was a wound communicating with the wound in the back; the *left* pleura contained a very large quantity of dark fluid blood; the left lung was lightly adherent all over to the parietal pleura by fibrinous strands; there was a hæmorrhage the size of an orange into the base of the left lung (no foreign body was found). The lung was partially collapsed and airless. *Right* lung: There was a pneumonic patch at the base, on the edge of the lobe, about the size of a mandarin. Had a lot of mucopus in the trachea. Heart: Except that there was slight excess of pericardial fluid, which was darker than normal, there was no lesion.

**Abdomen :** It was distended, but there was no blood or peritonitis. Everything appeared to be normal except that the intestines were distended, especially the large bowel down to the commencement of the iliac colon.

**Pathological report :** Films from the pneumonic lung and from the left-sided hæmothorax both showed pneumococci.

**Comment :** There is very little doubt that the pneumococcal infection in this case originated in the bronchitis from which the man was suffering at the time of wounding.

#### CASE 65.—Wound of Iliac Colon and Ureter with Peritonitis.

*Clinical History.*—Nature of wound : Bullet wound of sacral region.

**Signs and symptoms :** Hit to one side of the sacrum with a bullet, coming out through left groin. Operated upon shortly after admission ; did fairly well for a day or two, then started to vomit ; this continued until he died. Never had any urinary trouble.

**Operation :** Laparotomy. Iliac colon shot completely through ; wound of peritoneum just near pelvic brim. A catheter was passed into the bladder ; it drew off a small amount of blood-stained urine. The bladder appeared to be uninjured. The colon was sutured.

**Survival :** Four to five days.

*Post-mortem Result.*—Abdomen : General peritonitis. Suture line all right. A retroperitoneal hæmorrhage in the left side of the pelvis had become infected. There was a perforation of the posterior wall of the left ureter about one and a quarter inches from the bladder. The bladder, the remainder of the ureter, and the kidney, were healthy.

A retroperitoneal hæmorrhage had evidently become infected from the escaping bowel contents, getting in through the hole in the peritoneum. It was possible of course that the urine had infected it, but I am practically sure that this was not so ; the bruising around the perforation of the ureter was evidently sufficient to prevent any escape of urine.

? Was the peritoneum reinfected from the retroperitoneal suppuration.

**Comment :** Retroperitoneal sepsis is very dangerous, as we have seen in a previous case, and I don't know what one can possibly do for it.

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## Current Literature.

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**BOARD OF CONTROL. Lunacy and Mental Deficiency. The Twenty-Fifth Annual Report of the Board of Control for the Year 1938.** [BROCK, L. G., Chairman]. Part I. Pp. v + 80. 1939. London, H.M.S.O. [1s. 6d.]

The report begins by stating that the position of the public mental hospitals regarding bed accommodation is not as bad as was anticipated in the report for 1937, as accommodation increased during the year by 2,259 beds. At the same time the death-rate fell, while the increase in direct

admissions was more than balanced by the increase in absolute discharges and departures. There is still an aggregate deficiency in bed space of nearly 3,000, and it is to be regretted that the building of proposed new hospitals for Essex and Lancashire has not yet begun, while although sites have been acquired for new hospitals in Surrey and the West Riding, they are not likely to be completed for a considerable time.

The number of new out-patient centres continues to increase. Those run by or in conjunction with the staffs of mental hospitals number 177, the number of patients presenting themselves for treatment being over 19,000, and the number of attendances 74,000. There are at least 25 centres in the London area conducted independently of mental hospitals, and 32 in different parts of the country, while only three public mental hospitals in England have no such centres associated with them. The suggestion mentioned in the report for 1937 that part-time psychotherapists be appointed in public mental hospitals has been adopted at one of the L.C.C. mental hospitals.

The increased proportion of voluntary patients is satisfactory, but there is too wide a margin between the more and the less progressive hospitals in this respect. The percentage of voluntary admissions in some hospitals is over 70, while in seven it is under 15 per cent, and in 27 others between 15 per cent and 25 per cent. It is held by some doctors that if a patient has to enter a mental hospital the fact of entry cannot be concealed, and that it is relatively unimportant to what legal category he belongs, but it is pointed out by the Board that when he recovers it makes a great difference to his peace of mind if he can console himself that he was not certified, while if he does not recover the avoidance of certification saves the relatives from distress.

At the end of 1938 there were 158,723 persons suffering from mental disorder and notified under care in England and Wales, of whom 142,897 were rate-aided, 14,972 private, and 854 were criminal. Of the total number 133,827 were in institutions provided by local authorities, 275 were in private care, and 3,560 were on outdoor relief, the remainder being in registered hospitals, licensed houses, approved nursing homes, and public assistance institutions. The number of voluntary patients was 10,297, while temporary patients numbered 630.

There were 31,408 direct admissions and 20,456 discharges and departures during the year 1938.

The death-rate was 6.57 per cent of the average daily number resident as compared with an average of 6.94 per cent for the preceding quinquennium.

The incidence of tuberculosis was 8.3 cases per thousand, while 565 cases of dysentery was the highest figure during the last ten years. This was due to infection by the Sonne organism, an infection which has become increasingly prevalent in the general community.

The results of treatment by insulin and cardiazol obtained from a ques-

tionary circulated to mental hospitals are included in a summary. The returns relate to 3,531 completed cases and are divided between 92 institutions, of which 3 employed insulin only, 61 cardiazol only, 16 insulin and cardiazol combined, and 12 insulin and cardiazol given at different times. The results in those cases in which three or more months had elapsed since treatment ended show that of cases which left hospital 138 showed a complete remission with insulin, 542 with cardiazol, and 27 with both ; 36 showed an incomplete remission with insulin, 134 with cardiazol, and 16 with both, while 34 showed a partial remission with insulin, 152 with cardiazol, and 12 with both.

Of cases which remain in hospital, 50 were ameliorated with insulin, 594 with cardiazol, and 30 with both ; 114 were unchanged with insulin, 1,220 with cardiazol, and 80 with both, while 9 were made worse with insulin, 110 with cardiazol, and three with both.

Nineteen deaths occurred, six in patients who were having insulin treatment, 10 cardiazol, and three both. The clinical opinion with regard to triazol, which had only been tried in 92 cases, was that it gave results broadly analogous to those of cardiazol.

The number of mentally defective persons in institutions and under statutory care in the community at the end of 1938 was 89,904, males accounting for 51.2 per cent and females 48.8 per cent. About 46,000 defectives were in institutions provided under the Mental Deficiency Act, while 39,000 were under statutory supervision. In only few areas does the number of defectives who are in institutions or under care closely approximate to the number ascertained as subject to be dealt with. In some areas large numbers are in receipt of poor relief and in others, although there has been a large ascertainment, action has not been taken in many cases. There is a decrease in the number of persons on licence from institutions owing to the anti-social behaviour of defectives on licence, to which prominence was given in legal proceedings. In 1938, 755 were discharged from orders, while 493 deaths occurred, being a proportion of 1.2 per cent of the daily average number resident.

The emergency hospital scheme provided for the total evacuation of four mental hospitals and one mental deficiency colony and the partial evacuation of one mental deficiency colony, while the remaining mental hospitals, with a few exceptions, and 20 selected mental deficiency institutions, were to allocate approximately 25 per cent. of their normal accommodation for civilian casualties. In addition, the erection of hutments at certain institutions will give further casualty beds, resulting in a total of 41,000 casualty beds for use in an emergency.

The usual statistical tables and appointments of medical superintendents are included in the report.

LOUIS MINSKI.

*Reprinted from "Bulletin of Hygiene," Vol. 15, No. 2.*

MINISTRY OF HEALTH. **Memorandum on Influenza.** (Revised Edition.)  
[2d.] Memo 2/Med. 11 pp., 1 chart. 1939. London: H.M.S.O.

This is a useful memorandum placing the practitioner and the public in possession of the chief features of the disease, pointing out the points of distinction between epidemic influenza and mere febrile catarrh, the way in which infection is conveyed and contracted, the measures advised for personal protection such as general ventilation and the use of gargles. Vaccination with the virus has not yet passed beyond the stage of experiment, and face-masks may do harm rather than good by bringing about congestion of mucosæ and greater liability to infection. The action to be taken by sanitary authorities is summed up in notification, closure of schools, and provision of institutional treatment. The risks of attending places of public entertainment, and the doubtful value of disinfection of premises by spraying are mentioned.

H. H. S.

*Reprinted from "Bulletin of Hygiene," Vol. 15, No. 2.*

DRUMMOND, J. C., GRAY, C. H., and RICHARDSON, N. E. G. **The Anti-rachitic Value of Human Milk.** *Brit. M. J.* 1939, October 14, 757-60. [21 refs.]

Summing up the information regarding Ca and P intake, the authors point out that assimilation of Ca and P is most satisfactory within a narrow range of the Ca : P ratio—between 1 and 2; that at any given Ca : P ratio, assimilation improves as the total intake of the two components rises; and that administration of vitamin D at any level of Ca : P intake improves the deposition of the bone material, but its influence is most marked when the total Ca : P intake is low or when the values of the ratio are outside the desirable range. In former days, the diets of the poorer classes in England often contained 2 grammes of Ca a day and the Ca : P ratios were good, thanks to the extensive use of wholemeal bread, milk, and cheese; such a diet required the minimum amount of vitamin D. To-day, the poorer section of the community subsists on diets containing 0.2-0.5 gramme Ca daily and relatively high amounts of P, giving Ca : P ratios as low as 0.2. Diets of this type are greatly improved in their effect upon bony structure by increasing the Ca content even without any further addition of vitamin D. Since breast-fed infants are less susceptible to rickets than those artificially fed, human milk was tested for vitamin D content and a mean value of 6 I.U. per 100 millilitres was obtained. Cow's milk contains 1.5-2.3 I.U. per 100 millilitres in summer and 0.5-0.7 I.U. in winter. Although the evidence is somewhat conflicting, the authors believe that the D content of human milk can be increased by a high D intake. Two hundred I.U. daily is given as the minimum D requirement of pregnant women. The high doses of 1,000-5,000 I.U. sometimes used for infants are considered too large. From figures given it would appear that 300-500 I.U. are adequate. The Ca : P

ratio of human milk (2) approximates to that of bone (2·2), whereas the ratio in cow's milk is 1·5. This may be one reason for the better utilization of minerals from breast milk. The total concentration, however, of Ca and P in human milk (Ca 27–34 mgm. per cent, P 13–17 mgm. per cent) is relatively low as compared with cow's milk (Ca 100–160 mgm. per cent, P 70–100). The figures suggest that the breast-fed baby is receiving surprisingly little Ca, and the possibility must be considered that osteoporotic changes in bones firm at birth may occur during breast feeding. It is suggested that the newborn infant may have a store of Ca as it has of Fe to carry it over the period of exclusive milk diet. No reliable evidence was obtained that the Ca or P content of human milk could be increased by high intakes.

DOUGLAS C. HARRISON.

*Reprinted from "Bulletin of Hygiene," Vol. 15, No. 2.*

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## Reviews.

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BULLETINS FROM THE INSTITUTE FOR MEDICAL RESEARCH, FEDERATED MALAY STATES. No. 2 of 1938. Notes on the Chemotherapy of Malaria. By J. W. Field.

Clinical research owes yet another debt to the Institute for Medical Research, F.M.S., for this very comprehensive monograph, based on a series of lectures delivered by the author, Dr. J. W. Field, at the Fourth International Course in Malariology held under the direction of the Health Organization, League of Nations, in Singapore.

With the possible exception of Nocht and Mayer's excellent but somewhat biased handbook I know of no recent work covering anything like the same ground.

The author has treated his subject in a highly critical, impartial, and scientific manner, and the well-balanced conclusions arrived at should prove of special value in these days of the almost passionately protagonistic or antagonistic attitude adopted by many towards the new synthetic anti-malaria remedies, with the relative merits and demerits of which this review largely deals.

Many of the conclusions arrived at are the result of large-scale and carefully controlled prophylactic and therapeutic experiments carried out by the staff of the Institute amongst the coolies on malarious plantations in the F.M.S.

In an introductory note Dr. A. Neave Kingsbury, Director of the Institute, states: "Continuous developments of synthetic drugs and their utilization have determined a spate of publications in which the conclusions drawn do not always tally with the presented data. May I utter a plea



that workers should report their findings in true perspective, making clear all lacunæ in their work and weighing judiciously the evidence when drawing their inferences."

This warning is more than ever necessary in these days of skilfully advertised and heavily subsidized synthetic patent remedies, to which class the new antimalaria drugs very definitely belong. Much of the literature on the subject, both within and without the recognized medical journals, is little more than thinly veiled advertisement, the one object of which is to sell the drug in question, and as such, needs *very* careful sifting before it can be taken at anything like its face value.

The Fourth General Report of the Malaria Commission, Health Organization, League of Nations, is incorporated at the end of the monograph as a useful appendix. S. S.

PRINCIPLES AND PRACTICE OF AVIATION MEDICINE. By Harry G. Armstrong, B.S., M.D., Captain, Medical Corps U.S. Army, Director Aero Medical Research Laboratory, Air Corps Material Division. London: Baillière, Tindall, and Cox. 1939. Pp. xii + 496. Price 36s.

This is a large book and the author states that he has spent four years and more collecting his material. A bibliography of some 150 works is given.

The volume is primarily a reference work and should be the standard book on aviation medicine for many years.

It is of chief interest to medical officers of air services, whether military or civil. The chapters on medical examination are full and complete. Chapters on the physiology of flying are of interest not only to Air Force medical officers, but to doctors and surgeons who may wish to evacuate casualties by air.

In the final chapter a brief description is given of the contra-indications for air medical transport. By carefully reading Chapters XIII, XVI, and XX, on the effects on the ear, anoxia (anoxæmia) and the effects of decreased atmospheric pressures, the surgeon can answer his own queries.

The chapter on Aeroembolism (XXI) is interesting; when many modern aeroplanes have a ceiling of 35,000 feet and it is expected this will soon be increased to 40,000, it is important to know that "bubbles of nitrogen appear in the cerebrospinal fluid at about 18,000 feet and in the blood and body tissues at 30,000 feet." It follows from these facts that passengers should not be flown at more than 18,000 feet unless they are in sealed cabins.

In Chapter XXII reference is made to the well-known work on high flying by Group Captain G. Struan Marshall, *O.B.E.*, of the *R.A.F.*, and photographs are reproduced of his oxygen suit.

Chapter XXIII describes the effect of "G" on the system, but neither "G" nor "black-out" appear in the index.

In the chapter on Accidents in Aviation (XXIV) a list of crash tools is

given. There are several items not mentioned which are found of use in Great Britain. A well-equipped rescue car, in addition to foam apparatus, for fire fighting, carries two suits of asbestos clothing, a long-handled ripping tool, and a long-handled hook for dragging.

The final chapter is disappointingly short. No reference is made to the paper on "Air Ambulances" in the *JOURNAL OF THE ROYAL ARMY MEDICAL CORPS*, April, 1934, and insufficient credit is given to the work of the Committee of the International Red Cross Societies, which has organized several conferences on Air Medical Transport. The author of "Aviation Medicine" appears to translate the French "Aviation Sanitaire" as "sanitary" aviation, and writes of sanitary appliances in machines! Chapter XXVI should be entitled "Air Relief and Air Medical Transport."

The Proceedings of the Budapest Congress and demonstration of air ambulances, at which the writer of this review was present, is mentioned, and a brief reference made to air ambulance work in Great Britain.

One paper of practical importance, read at this Congress, might have been mentioned, "Indications et Contre-indications du Transport par avion," by Dr. Lavislas Sawicz, of Poland.

Another point not touched on by Dr. Armstrong is the importance of training nurses in carrying out their duties in the air. The Polish Red Cross organized special courses of lectures and gave five hours' flying before the nurses were passed as proficient. In Great Britain similar instruction has been arranged and proficiency certificates given to successful candidates after ten hours' flying under different conditions.

In Hungary and France V.A.D.s are even given practice in parachute landing.

Finally a very important subject: "Preventive Medicine in Relation to Aviation," is touched on, and the paper read by Whittingham to the United Services Section quoted.

Air ambulances are not mentioned in the index, and details might well have been given of types of containers for dropping medical supplies by parachute.

This is a book worth studying, and it is hoped that the next edition will incorporate the above-mentioned suggestions.

**BRITISH RED CROSS SOCIETY. NOTE-BOOK WITH DIAGRAMS FOR USE DURING ATTENDANCE AT RED CROSS COURSES OF FIRST AID. Second Edition.** Edited by St. J. D. Buxton, M.B., B.S., F.R.C.S. Oxford University Press. London: Humphrey Milford. 1940. Pp. iv + 100. Price 2s. 6d.

This is a handy note-book with illustrations, and has ample space for making notes of lectures on the subjects illustrated by the diagrams. The publication should be useful for first-aid students of all classes.

H. A. S.

## Notices.

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### "HYPOLOID" MERSALYL.

"HYPOLOID" Mersalyl, issued by Burroughs Wellcome and Co., is stated to provide the medical profession with a highly effective diuretic preparation for administration by intravenous or intramuscular injection. The product consists of a 10 per cent solution of the sodium salt of salicyl-( $\gamma$ -hydroxy-mercuri- $\beta$ -methoxypropyl)-amide-O-acetic acid, with 5 per cent theophylline.

"Hypoloid" Mersalyl is considered to be a valuable diuretic in oedema of cardiac or renal origin, and to be particularly effective in the treatment of cardiac failure with oedema and diminished output of urine.

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### CYCLONAL SODIUM.

#### AN INTRAVENOUS ANÆSTHETIC BY MAY AND BAKER.

FOR induction, short basal narcosis, and total anæsthesia, sodium N-methyl-C-C-cyclohexenylmethylmalonylurea has been widely used during the past few years, although its manufacture has not been undertaken in this country. Now, however, the preparation is being produced in Great Britain by May and Baker, Ltd., under the name of Cyclonal Sodium, and supplies are available for immediate delivery.

Full details of the properties, clinical applications, administration, dosage and packings of this intravenous anæsthetic, are contained in an informative 60 page Cyclonal Sodium booklet which has recently been sent to us. Its administration intravenously and rectally is also described, together with the therapeutic applications of the drug.

A copy of the Cyclonal Sodium booklet will, we understand, be sent to any member of the medical profession on request to Pharmaceutical Specialities (May and Baker) Ltd., Dagenham.

## INDEX TO VOLUME LXXIV.

C.N. = Clinical and other Notes.

C.L. = Current Literature.

	PAGE		PAGE
Abscess, gangrenous, of the right lung, by Major M. B. Dick ... C.N.	352	Casualties in forward areas under fire, new appliances for the recovery and transport of, by Major St. Clair Barrett and Colonel E. M. Cowell ... C.N.	166
Alcohol and nicotine, abuse of, in Germany. Circular ... C.L.	305	Casualties, removal of, from a light tank (Mark VI), by Captain J. E. Elliott ...	45
Anxiety states, by Colonel H. Yellowlees ...	327	Cerebrospinal fever among troops, extracts from the memorandum on, from the Director of Pathology, War Office ...	212
Arsenic, organic preparations, two rare toxic manifestations due to treatment of syphilis with, by Lieutenant-Colonel H. G. Winter ... C.N.	161	Cerebrospinal meningitis, six cases of, treated with M & B 693, Military Isolation Hospital, Aldershot, by Major L. R. H. Keatinge ... C.N.	223
Bacterium typhosum. The development of Vi-antigen and Vi-antibody, by Major H. J. Bensted ...	19	Charterhouse Rheumatism Clinic, letters from Dr. H. Warren Crowe and Major Ellert Forbes ...	182
Barrett, Major St. Clair, and Colonel E. M. Cowell, new appliances for the recovery and transport of casualties in forward areas under fire C.N.	166	Chemotherapy in relation to war wounds, by Colonel L. Colebrook, Medical Society, Dieppe Area ...	192
Bensted, Major H. J., Bacterium typhosum. The development of Vi-antigen and Vi-antibody ...	19	Chief Medical Officer's Report for the year 1938. ... Editorial	342
Biggam, Lieutenant-Colonel J., a case of gonorrhœal ophthalmia aborted by early treatment ... C.N.	169	Clyne, Captain A. J., a case of severe vesicovaginal fistula treated by ureterocolic implantation ... C.N.	50
Blood groups, letter from Major-General H. Marrian Perry ...	311	Colebrook, Colonel L., chemotherapy in relation to war wounds. Medical Society, Dieppe Area ...	192
Blood groups, nomenclature of, letter from Dr. Neville M. Goodman, Ministry of Health ...	246	Copeman, Major W. S. C., notes on treatment of the rheumatic diseases in the B.E.F. ...	277
Board of Control Report, 1938. Lunacy and mental deficiency ... C.L.	361	Cowell, Colonel E. M., and Major St. Clair Barrett, new appliances for the recovery and transport of casualties in forward areas under fire ... C.N.	166
British Medical Society of the Dieppe area, inaugural meeting ...	185	Coyte, Lieutenant-Colonel R., a case of strangulation into Waldeyer's pouch ... C.N.	353
Brown, Dr. H. C., the laboratory diagnosis of Weil's disease ...	65	Crowe, Dr. H. Warren, Charterhouse Rheumatism Clinic Correspondence	118
Browning, Dr. Ethel, a case of severe generalized dermatosis treated by sulphonamide ... C.N.	231	Dansey-Browning, Captain G. C., some ophthalmic problems in Egypt, with special reference to mechanization	335
Bug, bed, disinfection, use of heavy naphtha in ... C.L.	62	Dental caries, factors in saliva correlated with ... C.L.	305
Buist, Major T. P., and Captain R. H. Simon, intensive treatment of gonorrhœa with M & B 693 ... C.N.	229	Dermatosis, generalized, a case of severe, treated by sulphonamide, by Dr. Ethel Browning ... C.N.	231
Burns, a case of, by Major J. S. Jeffrey ... C.N.	353	Dick, Major M. B., gangrenous abscess of the right lung ... C.N.	352
Canned foods in relation to health C.L.	179		
Case for diagnosis, by Major G. F. Harrison ... C.N.	292		
Case for diagnosis, by Major W. M. Priest ... C.N.	351		
Casualties, a useful form for recording, by Colonel T. H. Scott ... C.N.	354		

	PAGE		PAGE
Dick, Major M. B., retroperitoneal hæmatoma ... .. C.N.	352	Harben Lectures for 1940. Royal Institute of Public Health and Hygiene ... ..	160
Dieppe Area, British Medical Society of the, inaugural meeting ... ..	185	Harrison, Major G. F., a case for diagnosis ... .. C.N.	292
Diphtheria, compulsory vaccination against. Italy ... .. C.L.	304	Hepatitis, infective, and catarrhal jaundice, by Dr. G. M. Findlay ...	72
Disinfestation, bed-bug, use of heavy naphtha in ... .. C.L.	62	Hill, Sir Leonard, the penetration of rays through the skin and radiant energy for the treatment of wounds	1
Disinfesting and drying machine, a new portable hot air, by Brevet Lieutenant-Colonel A. E. Richmond	121	Hot air disinfesting and drying machine, a new portable, by Brevet Lieutenant-Colonel A. E. Richmond	121
ECHOES OF THE PAST:—		Human milk, the antirachitic value of ... .. C.L.	364
Twenty years after, by Dr. H. Skipton Stacy 52, 105, 171, 235, 300,	356	Hygiene laboratory, mobile, in Flanders, 1917, by Dr. P. R. McNaught ... ..	10
EDITORIALS:—		Influenza, epidemic, by Major C. H. Stuart-Harris ... ..	270
Annual Report of the Chief Medical Officer for the year 1938 ... ..	342	Influenza, memo on. Ministry of Health ... .. C.L.	364
Gas gangrene ... ..	92	Jaundice, catarrhal, and infective hepatitis, by Dr. G. M. Findlay	72
The control of tetanus ... ..	36	Jeffrey, Major J. S., a case of burns	353
Trench fever ... ..	216		
Trench foot ... ..	154	Keatinge, Major L. R. H., six cases of cerebrospinal meningitis treated with M & B 693, Military Isolation Hospital, Aldershot. ... .. C.N.	223
War nephritis ... ..	286	Laboratory, mobile hygiene, in Flanders, 1917, by Dr. P. R. McNaught ... ..	10
Elliott, Captain J. E., removal of casualties from a light tank (Mark VI) ... ..	45	Library, medical, for the British Expeditionary Force ... ..	222
Epidemic influenza, by Major C. H. Stuart-Harris ... ..	270	Library, reference, for the Medical Base in France. Royal College of Surgeons ... ..	160
Epidemics, contributions to the mathematical theory of ... .. C.L.	112	Lloyd Williams, Major I. H., on the manipulation of joints ... ..	86
Findlay, Dr. G. M., infective hepatitis and catarrhal jaundice ...	72	Lodge, Dr. W. O., a note on the present trend of mastoid surgery ... .. C.N.	98
Fistula, vesicovaginal, a case of severe, treated by ureterocolic implantation, by Captain A. J. Clyne ... .. C.N.	50	Lunacy and mental deficiency. Report, Board of Control, 1938 ... .. C.L.	361
Foods, canned, in relation to health	179	Lyburn, Captain R. StJohn, a case of myasthenia gravis ... .. C.N.	100
Foot-gear, by Dr. James Mennell ...	138	Lymphogranuloma venereum, with special reference to head and neck lesions ... .. C.L.	180
Forbes, Major Ellert, Charterhouse Rheumatism Clinic Correspondence	182	Mackenzie, Major D. W. M., and Staff-Serjeant A. F. Smith, experiment with a sunlight clinic ... .. C.N.	99
Fraser, Surgeon Lieutenant-Commander P. K., the treatment and prophylaxis of superficial ringworm infections ... ..	145	Manipulation of joints, on the, by Major I. H. Lloyd Williams ...	86
Gas gangrene ... .. Editorial	92	Mastoid surgery, a note on the present trend of, by Dr. W. O. Lodge	98
Gonorrhœa, intensive treatment of, with M & B 693, by Major T. P. Buist and Captain R. H. Simon	229		
Gonorrhœal ophthalmia, a case of, aborted by early treatment, by Lieutenant-Colonel J. Biggam	169		
Goodman, Dr. Neville M. (Ministry of Health), nomenclature of blood groups ... .. Correspondence	246		
Hæmolytic streptococcal infection of wounds in war, sources of ... .. C.L.	176		
Harben Gold Medal and Smith Award, 1940 ... ..	160		

	PAGE		PAGE
Max-Page, Colonel C., some reflections on the development of war surgery. Medical Society, Dieppe Area ...	192	Priest, Major W. M. a case for diagnosis ... C.N.	351
McNaught, Dr. P. R., a mobile hygiene laboratory in Flanders, 1917	10	Radiant energy, the penetration of rays through the skin and, for the treatment of wounds, by Sir Leonard Hill ...	1
Medical Library for the British Expeditionary Force ...	222	Rays, penetration of, through the skin and radiant energy for the treatment of wounds, by Sir Leonard Hill	1
Medical Society, Dieppe Area, inaugural meeting ...	185	Retroperitoneal hæmatoma, by Major M. B. Dick ... C.N.	352
Medical Society of the Vth Casualty Clearing Station, proceedings of the C.N.	103	REVIEWS:—	
Medical Society of the Vth Casualty Clearing Station, second meeting C.N.	299	A history of tropical medicine, in two vols., by H. Harold Scott ...	306
Mennell, Dr. James, foot-gear ...	138	An outline of medicinal psychology, by E. Fretson Skinner ...	244
Milk, human, the antirachitic value of ... C.L.	364	A pocket medical dictionary, fourth edition. Compiled by Lois Oakes and Thos. B. Davie ...	181
Mobile hygiene laboratory in Flanders, 1917, by Dr. P. R. McNaught	10	Artificial limbs in their relation to amputations. H.M. Stationery Office ...	116
Monro, Lieutenant-Colonel D. C., surgery in the Army ...	249, 314	Asthma, second edition, by Frank Coke ...	63
Monro, Lieutenant-Colonel D. C., surgical rearmament ...	205	British Red Cross Society. Notebook for use during courses of first-aid ...	367
Myasthenia gravis, a case of, by Captain R. StJohn Lyburn ... C.N.	100	Bulletin from Institute for Medical Research, Federated Malay States, No. 2, 1938. Malaria ...	365
Naphtha, use of heavy, in bed-bug disinfection ... C.L.	62	English, German, French, Italian, Spanish medical vocabulary and phrases, by Joseph S. F. Marie ...	182
Nephritis, war ... Editorial	286	First-aid to the injured and sick (Warwick and Tunstall). Edited by F. C. Nichols ...	246
Nicotine and alcohol, abuse of, in Germany. Circular ... C.L.	305	Food values at a glance and how to plan a healthy diet, second edition, by Violet G. Plimmer ...	244
NOTICES:—		Fractures and other bone and joint injuries, by R. Watson-Jones ...	114
Carbachol. Burroughs, Wellcome and Co. ...	311	Medical organization and surgical practice in air raids, by Colonels P. H. Mitchiner and E. M. Cowell	116
Chadwick Public Lectures, March to June, 1940 ...	183	Modern psychotherapy, by Noel Harris ...	310
Cyclonal sodium ...	368	Pathological histology, by Robertson F. Ogilvie ...	243
"Hypoloid" mersalyl ...	368	Principles and practice of aviation medicine, by Harry G. Armstrong	366
Stibophen ...	183	Straight tips for "Subs.", fourteenth edition, by the late Captain A. H. Trapman ...	246
"Tabloid" "Emocin" throat lozenge ...	182	Sulphanilamide and its derivatives in the routine treatment of gonorrhœa in the tropics. Bulletins, Institute for Medical Research, Federated Malay States ...	245
"Tabloid" "Theoba" ...	118	Surgery of the hand, by J. H. Couch	245
The National Central Library: how it is helping in time of war ...	119		
Uropac. May and Baker ...	311		
Ophthalmia, gonorrhœal, a case of, aborted by early treatment, by Lieutenant-Colonel J. Biggam C.N.	169		
Ophthalmic problems in Egypt, with special reference to mechanization, by Captain G. C. Dansey-Browning	335		
Perry, Major-General H. Marrian, blood groups ... Correspondence	311		
Presidential address, by Major-General R. Priest. British Medical Society of the Dieppe Area ...	186		
Priest, Major-General R., Presidential address, British Medical Society of the Dieppe Area ...	186		

	PAGE		PAGE
Surgical diagnosis, by Stephen Power ... ..	117	Surgery in the Army, by Lieutenant-Colonel D. C. Monro ... ..	249, 314
Synopsis of surgery, eleventh edition, by Ernest W. Hey Groves ... ..	181	Surgery, war, some reflections on the development of, by Colonel C. Max-Page. Medical Society, Dieppe Area	192
Test questions and model answers on first-aid, by E. S. Brown ... ..	246	Surgical rearmament, by Lieutenant-Colonel D. C. Monro ... ..	205
Textbook of medicine, fourth edition, edited by J. J. Conybeare ... ..	63	Syphilis, treatment of, with organic arsenic preparations, two rare toxic manifestations due to, by Lieutenant-Colonel H. G. Winter ... ..	C.N. 161
The early diagnosis of the acute abdomen, eighth edition, by Zachary Cope ... ..	310	Tank, light (Mark VI), removal of casualties from a, by Captain J. E. Elliott ... ..	45
The sanitary inspector's handbook, fourth edition, by Henry H. Clay	115	Tetanus, the control of	Editorial 36
Treatment by manipulation, by H. Jackson Burrows, and W. D. Coltart ... ..	181	Toxic manifestations, two rare, due to treatment of syphilis with organic arsenic preparations, by Lieutenant-Colonel H. G. Winter ... ..	C.N. 161
Tuberculosis and national health, by H. Hyslop Thomson ... ..	242	Trench fever ... ..	Editorial 216
Rheumatic diseases in the B.E.F., notes on treatment of the, by Major W. S. C. Copeman ... ..	277	Trench foot ... ..	Editorial 154
Richmond, Brevet Lieutenant-Colonel A. E., a new portable hot air disinfecting and drying machine ... ..	121	Trist, Lieutenant-Colonel J. R. R., the problem of sick wastage in war ... ..	80
Ringworm infections, superficial, the treatment and prophylaxis of, by Surgeon Lieutenant-Commander P. K. Fraser ... ..	145	Twenty years after, by Dr. H. Skipton Stacy ... ..	Echoes of the Past 52, 105, 171, 235, 300, 356
Scott, Colonel T. H., a useful form for recording casualties ... ..	354	Vesicovaginal fistula, a case of severe, treated by ureterocolic implantation, by Captain A. J. Clyne ... ..	C.N. 50
Sewerage and water works. Galvanic corrosion stopped by water treatment C.L.	61	War nephritis ... ..	Editorial 286
Sick wastage in war, the problem of, by Lieutenant-Colonel J. R. R. Trist ... ..	80	War surgery, some reflections on the development of, by Colonel C. Max-Page. Medical Society, Dieppe Area	192
Simon, Captain R. H., and Major T. P. Buist, intensive treatment of gonorrhœa with M & B 693 C.N.	229	War wounds, chemotherapy in relation to, by Colonel L. Colebrook. Medical Society, Dieppe Area	192
Smith Award and Harben Gold Medal, 1940 ... ..	160	Wastage, sick, in war, the problem of, by Lieutenant-Colonel J. R. R. Trist ... ..	80
Smith, Staff Serjeant A. F., and Major D. W. M. Mackenzie, experiment with a sunlight clinic ... ..	99	Water, significance and value of the total count in the bacteriological test of ... ..	C.L. 113
Stacy, Dr. H. Skipton, twenty years after ... ..	Echoes of the Past 52, 105, 171, 235, 300, 356	Water works and sewerage. Galvanic corrosion stopped by water treatment C.L.	61
Strangulation into Waldeyer's pouch, a case of, by Lieutenant-Colonel R. Coyte ... ..	C.N. 353	Weil's disease, the laboratory diagnosis of, by Dr. H. C. Brown	65
Streptococcal, hæmolytic, infection of wounds in war, sources of ... ..	C.L. 176	Winter, Lieutenant-Colonel H. G., two rare toxic manifestations due to treatment of syphilis with organic arsenic preparations ... ..	C.N. 161
Stuart-Harris, Major C. H., epidemic influenza ... ..	270	Wound infection, dosage of sulphanilamide prophylaxis of ... ..	C.L. 239
Sulphanilamide prophylaxis of wound infection, dosage of ... ..	C.L. 239	Wounds, the penetration of rays through the skin and radiant energy for the treatment of, by Sir Leonard Hill ... ..	1
Sunlight clinic, experiment with, by Major D. W. M. Mackenzie, and Staff Serjeant A. F. Smith ... ..	99	Wounds, war, excision of ... ..	C.L. 178
		Yellowlees, Colonel H., anxiety states	327



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EDITED BY  
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ASSISTANT EDITOR :  
LIEUTENANT-COLONEL H. A. SANDIFORD, *M.C., R.A.M.C.*

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THE



## Royal Army Medical Corps



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### CONTENTS

#### ORIGINAL COMMUNICATIONS.

PAGE

Further Notes on the Treatment of Gonorrhoea with the Sulphonamide Group of Drugs. By Lieutenant-Colonel H. G. WINTER, <i>M.C., R.A.M.C.</i>	1
Lymphocytic Choriomeningitis with Report of a Case. By G. M. FINDLAY, <i>C.B.E., M.D., D.Sc., Major C. H. STUART-HARRIS, M.D., M.R.C.P., R.A.M.C.</i> and F. O. MACCALLUM, <i>M.D., B.Sc.</i>	8
The Treatment of General Peritonitis following Acute Appendicitis. By Captain A. J. CLYNE, <i>R.A.M.C.</i>	16
Duties of a Quartermaster's Department in Peace. By Captain (Quartermaster) J. G. EVES, <i>M.B.E., R.A.M.C.</i>	25

#### EDITORIALS.

The Treatment of Anaerobic Infections with Sulphapyridine and with Immune Sera and the Problem of Synergic Action	38
Action of Antiseptics on Wounds	40

#### CLINICAL AND OTHER NOTES.

PAGE

Two Cases of Undulant Fever Treated with Sulphanilamide. By Captain R. J. G. MORRISON, <i>R.A.M.C.</i>	45
A Method of Carrying Thomas' Splints in Motor Ambulances. By Major T. D. M. MARTIN, <i>R.A.M.C.</i>	47
Congenital Absence of Pectoral Muscles. By Major F. M. RICHARDSON, <i>R.A.M.C.</i>	48
Massive Collapse of the Lung. By Major P. F. PALMER, <i>R.A.M.C.</i>	48
Radiographic Tubestand for Use with a Field Service X-ray Outfit. By Major R. B. GUYER, <i>M.B., Ch.B., D.M.R.E., R.A.M.C. (S.R.).</i>	50

#### ECHOES OF THE PAST.

Life in a C.C.S. during the Great War. By Lieutenant-Colonel L. T. CHALLENGOR, <i>R.A.M.C.</i>	53
Enemy Troop Carriers	58
CURRENT LITERATURE	62
REVIEWS	65
NOTICES	67

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FURTHER NOTES ON THE TREATMENT OF GONORRHOEA WITH  
THE SULPHONAMIDE GROUP OF DRUGS.

BY LIEUTENANT-COLONEL H. G. WINTER, M.C.,  
*Royal Army Medical Corps.*

In a previous article in this Journal, written in July, 1938 (Winter, 1939), the author described his findings after a year's work with the sulphonamide group of drugs in the treatment of gonorrhœa. This work has continued and, after a further year, it is considered that sufficient data has now been accumulated to justify the formulating of a routine method for the treatment of this disease.

During the past year, the majority of cases have been treated with sulphanilamide and M & B 693, but small quantities of albucid and streptocide have also been tried. In the case of both the latter drugs, results were disappointing. In the present article, for the sake of brevity, the drugs will be referred to under two headings—"Sulphonamide" and "M & B 693."

M & B 693 is undoubtedly the drug of choice in any stage of the disease, and has the great advantage of being equally therapeutically efficient even in the very earliest stages. The sulphonamides are effective only if withheld for at least ten days to allow of the development of some degree of immunity, at which stage they have almost equal therapeutic value; this, however, means increased hospitalization. As against this objection, many hospitals and medical stores hold large stocks of these latter drugs which, incidentally, are only about a quarter of the price of M & B 693; they could, therefore, be used for the treatment of gonorrhœa in the absence of supplies of M & B 693 or until surplus stocks of the sulphonamides were used up, provided that the method of administration described below is followed.



## 2 *Treatment of Gonorrhœa with the Sulphonamide Group of Drugs*

These findings are in agreement with Cokkinis (1939), who states that M & B 693 is 1·8 times more potent in gonorrhœa than the sulphonamides, and that the latter drugs do not cure a high percentage in the first week but that a big change for the better takes place in the second week. Uleron is still weaker and therefore requires a still higher degree of immunity. He places the drugs in the following order :—

Treatment of the patient in the first week : M & B 693.

Treatment of the patient in the second week : Sulphonamide.

Treatment of the patient in the third week : Uleron.

The following further facts have come to light during the present trials :—

(1) Complement-deviation tests were done before treatment, seven days after commencement of treatment, and one month after cessation. Sulphonamide treatment was quite definitely most effective in those cases in which this test was positive at the commencement. With M & B 693, it did not appear to matter whether the test was positive or negative. This test is consequently a valuable indicator in treatment with the sulphonamides. Hartung (1938) came to a similar conclusion regarding the complement-deviation test when working with uleron. This observer found that the test became positive in the majority of uncomplicated cases after about a fortnight and increased thereafter—earlier in cases in which complications developed. He further found that the results of treatment were invariably better in patients showing a positive reaction. In the series under review, moreover, it was found that cases with a previous history of gonorrhœa in the last one or two years did well on both M & B 693 and sulphonamide.

(2) In the earlier cases treated with sulphonamide (Methods 17 and 18) vaccine in full doses was given as preliminary treatment in an endeavour to raise immunity before the administration of the drug. These cases did not do so well on the whole as those which received no preliminary treatment. Later, following Hartung (1938), who observed that large doses of vaccine, sufficient to produce a feverish reaction, caused a positive complement-deviation test to become negative again, subcurative doses only were given (about half or less of the normal dose); results were very much better (Method 20). In a few cases patients were given a bottle of beer a day as part of the preliminary treatment in an endeavour, deliberately, to increase the severity of the disease: it had been observed that cases with the most copious mucopurulent urethral discharge, swarming with gonococci, did best under subsequent treatment.

(3) Total white blood-cell counts were made before treatment, on the third day after commencement of treatment and on the completion of treatment. In the case of sulphonamide, it was found that the patients who showed a mild leucocytosis, in the neighbourhood of 10,000 per c.c., which dropped by at least 20 per cent to round about 8,000 or less by the third day, did well. Cases in which the initial count was normal, or only slightly raised, and in which there was little or no drop, or even a rise, on the third day, did not respond to treatment. With M & B 693, the drop on the third day was

even more marked in the majority of cases, but an absence of initial leucocytosis or drop during treatment did not appear to bear any relation to the therapeutic result. In view of the shortness of the course (four days only), blood examination is of little or no value in predicting possible toxic effects.

(4) Forgan (1939) casts some doubt as to the advantage of restricting sulphur intake during treatment. A number of cases were left on ordinary diet whilst taking large doses and came to no harm.

(5) Recent work has shown that these drugs are not absorbed by the stomach but by the small intestine, and that concentration in the blood reaches a maximum in three hours, falling to zero in twenty-four hours. Concentration in the cerebrospinal fluid is as great as in the blood. Excretion is in the urine. Rate of elimination is independent of the plasma level but follows urine flow; the drug is apparently filtered out by the glomeruli but 70 to 80 per cent is reabsorbed by the tubules. M & B 693 is absorbed slightly more slowly than sulphonamide. Absorption of both is facilitated by the administration of sodium bicarbonate or dilute hydrochloric acid (Buttle, 1939). It therefore follows that to obtain optimum therapeutic effect, the drug should be given in conjunction with sodium bicarbonate and the fluid intake should be restricted during treatment, although Lloyd (1939) suggests that such restriction may lead to intolerance; no cases of intolerance from this cause were noted in the present series. Toxic effects can be combated by increase in the fluid intake and by diuresis; administration of sodium bicarbonate in cases of gastric disturbance does not benefit the condition as it only facilitates further absorption of the drug (Buttle, 1939).

(6) Most observers agree that it is essential to maintain a high concentration in the blood for short periods. Low dosage, often for several weeks, is not only therapeutically useless but renders the patient resistant to further treatment, possibly by stimulating the liver to detoxicate larger quantities of the drug (Lloyd, 1939). The best results are obtained when the concentration in the blood is quickly raised to a high level—5 or more mgm. per cent, equivalent to 3 to 5 gramme doses daily (Lloyd, 1939). These findings are borne out by observers in the United States of America (Venereal Diseases Information, 1938) who advocate large doses, contending that symptoms necessitating discontinuance are not frequent enough to constitute serious limitations; with doses of 6 to 8 grammes per diem, they claim 70 to 80 per cent cures. They further state that with smaller doses results are less definite (cures only 45 to 75 per cent), and that symptomatic cure only is obtained with possible formation of the carrier state. Concentration in the blood falls during the night and it has been suggested (Forgan, 1939) that the drug acts as a food and that gastric symptoms are a form of night starvation. In the series under review, marked improvement resulted when patients were given an extra dose at midnight (Method 26). The best results were obtained in the present series when a large initial dose (4 tablets

#### 4 *Treatment of Gonorrhœa with the Sulphonamide Group of Drugs*

= 2 grammes) was given, followed by 2 tablets (= 1 gramme) two-hourly and a further dose of 1 gramme at midnight (Method 26).

(7) Toxic manifestations were all of a relatively mild nature and could, with safety, in the majority of cases be disregarded; if more severe, they disappeared promptly on discontinuance of the drug for twenty-four hours and the exhibition of copious fluids. Chief amongst these toxic reactions were nausea, vomiting, abdominal pain, diarrhoea, headache, dizziness, and mental dullness. A few patients developed cyanosis which was looked on as of no consequence in view of Buttle's (1939) contention that this is partly due to elaboration of pigments. Gastric symptoms were slightly less in evidence after the midnight dose was introduced, thus bearing out Forgan's (1939) contention referred to above. Drug fever occurred in one or two cases and in one it was particularly definite. All rashes noted were of the morbilliform or of the scarlatiniform type; none of them was very severe. No bullous eruptions as described by Simon (1939) were observed. With a view to testing the photosensitizing action of these drugs, as described by Newman and Sharlit (1937), Erskine (1939), Hallam (1939), and other observers, a number of cases who were taking large doses of M & B 693 were allowed to sun-bathe in the Hills in India at midsummer until they were well sun-tanned; in no case was light-sensitiveness apparent.

American observers (Long, 1939) report cases of "acetyl-sulfapyridine stone" formation in the kidneys with hæmaturia, anuria, and nitrogen retention in some instances amongst cases under treatment with "sulfapyridine." None of the cases under treatment in the present series has so far developed any symptoms of this nature.

(8) In the series, two cases were particularly resistant to both sulphonamide and M & B 693; they eventually reacted only to prolonged local treatment. In such cases, which are apparently sulphonamide-resistant, there is no advantage to be gained in persevering with treatment by these drugs. In these cases there was strong suspicion which, unfortunately, could not be sustained, that the patients, who were nursing orderlies, had been practising self-treatment with small doses of the drug for some time before reporting sick.

(9) Therapeutic results are so encouraging in the early stages of the disease under treatment with M & B 693 that it is suggested that prophylactic use of this drug might be seriously considered. Lloyd (1939) suggests its use as a prophylactic but states that so far it has not been so used although, experimentally, it has been a successful prophylactic in mice. It is suggested that a supply of tablets might be issued to the preventive ablution centres of one or more selected units; issues to individuals to be controlled by means of a carefully kept register. Suggested prophylactic dosage is 4 tablets (2 grammes) at once, followed by 2 tablets (1 gramme) in four hours or at reveille next morning.

*The following routine treatment courses are recommended:—*

*M & B 693 (for choice).—May be commenced on the first day of the*

disease. Restriction in diet (avoidance of eggs, onions, etc.) is advisable but not essential; it is a good plan to give glucose barley sugar during treatment, to protect the liver. Restriction in fluid intake is important. There is no advantage in doing either a complement-deviation test or a total white blood-count. During the course, a simple alkaline mixture, containing sodium bicarbonate, 60 grammes, given three times a day, assists absorption.

*Course.*—Commencing at 07-00 hours daily.

1st day : Initial dose of 4 tablets (2 grammes), followed by a dose of 2 tablets (1 gramme) every two hours for five doses.

2 tablets (1 gramme) at midnight.

2nd and 3rd days : 2 tablets every two hours for six doses.

2 tablets at midnight each night.

4th day : 2 tablets every three hours for five doses.

2 tablets at midnight.

Total for the course = 56 tablets (28 grammes).

If necessary, the course may be repeated after a rest interval of three days.

*Sulphonamide.*—It is essential to wait for at least ten days before commencing treatment. Patients are kept in bed during this period and warned against the infectivity of their disease, especially as regards conjunctival infection. If the urethral discharge is scanty and the disease mild, a bottle of beer a day is given. The complement-deviation test is done soon after admission and again in a week's time. Total white blood-count is also made early and repeated in three to four days.

If the complement-deviation test becomes positive or if complications, such as acute epididymitis or acute prostatitis, supervene, drug treatment can be commenced immediately, otherwise the full ten days' wait is insisted on.

During the preliminary period, subcurative doses (half or quarter normal) of vaccine are an advantage, but should be discontinued if any general reaction follows.

The course given is exactly the same as that described in detail under M & B 693, above.

No local treatment is necessary in a straightforward case treated with either M & B 693 or sulphonamide, but only in those cases which are resistant to the drug.

My thanks are due to Colonel J. E. Ellcome, V.H.S., A.D.M.S., Lahore District, and to Colonel E. G. S. Cane, D.S.O., A.D.M.S., Rawalpindi District, for permission to send these notes for publication; and I am indebted to Captain R. J. Niven, R.A.M.C., for assistance and suggestions in managing the cases, and to Sergeant R. Elbrow, R.A.M.C., for assistance with cases and for collection and compilation of statistics.

# 6 Treatment of Gonorrhœa with the Sulphonamide Group of Drugs

## STATISTICS.

OBSERVATIONS ON A FURTHER 93 CASES TREATED. ALL FIGURES ARE AVERAGE.

Method number	1	2	3	4	5	6	7	8	9	10	11
Number of cases	13	17	8	11	8	2	4	3	6	8	13
Drug used	Sulphanilamide	Sulphanilamide	Sulphanilamide	Sulphanilamide	Sulphanilamide	Albucid	Streptocide (oral)	Streptocide (oral and parenteral)	M & B 693	M & B 693	M & B 693
Amount of drug per diem	6 grms.	6	7	7	7	7	4	4	10	7	7
Total amount of drug per case	24 grms.	24	28	28	28	28	24	13	30	28	28
Preliminary treatment	Nil	Vaccine (full doses)	Vaccine (full doses)	Vaccine (full doses)	Vaccine sub-curative doses	Nil	Nil	Nil	Nil	Nil	Nil
Day of disease on which the drug was commenced	14	16	10	11	13	7	7	4	5	10	5
Number of days required to effect cure from commencing the drug	8	12	11	15	7	—	—	—	14	10	5
Total number of days under treatment from the date of onset of the disease to cure	22	28	21	26†	20	—†	—§	—§	19	20	10
Number of cases which relapsed subsequently	1*	1*	1*	—	—	—	—	—	—	—	—
Remarks	<p>*The cases which relapsed, reacted to a further course later</p> <p>†Two of the cases in this series were resistant (one of them suffered from thyroid deficiency and it is interesting to note that he had previously been resistant to antisyphilitic treatment for the past three years). These cases were later given M &amp; B 693 and eventually responded to prolonged local treatment.</p> <p>‡These cases did not respond and later reacted to M &amp; B 693 therapy.</p> <p>§This drug did not appear to be very therapeutically active. In five cases, gonococci were present in smears on the fourth day and in the other two on the 13th and 17th respectively. Four subsequently cleared up under local treatment and three after a course of M &amp; B 693.</p> <p>All cases were amongst British troops. Indian troops tolerate similar doses equally well.</p>										

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# LYMPHOCYTIC CHORIOMENINGITIS WITH REPORT OF A CASE.

BY G. M. FINDLAY, C.B.E., M.D., D.Sc.,  
MAJOR C. H. STUART-HARRIS, M.D., M.R.C.P.,<sup>1</sup>

*Royal Army Medical Corps,*

AND

F. O. MACCALLUM, M.D., B.Sc.,  
*Wellcome Bureau of Scientific Research, London.*

THE past twenty years have witnessed a great increase in our knowledge of the viruses capable of attacking the central nervous system of man.

Encephalitis lethargica, first recognized as a clinical and pathological entity in Vienna by von Economo (1917), was responsible for a series of epidemics between 1920 and 1926, but has now almost entirely disappeared. Its present diminished prevalence suggests either a fall in the virulence of the causative agent, possibly a virus related to that of herpes simplex, or else a higher degree of immunity among the inhabitants of the countries affected. A number of other neurotropic virus infections have since been recognized. They include St. Louis encephalitis and equine encephalomyelitis in the United States of America; type B encephalitis in Japan; spring-summer encephalitis in the U.S.S.R.; swineherds' disease (*maladie des porchers*) in Eastern France and Switzerland; X disease in Australia; louping ill, an infection of sheep in the border counties of England and Scotland and in laboratory workers, and B virus infection in individuals bitten by rhesus monkeys. The most widely distributed of these new virus diseases, however, is that known as lymphocytic choriomeningitis.

## HISTORICAL.

During the transmission to rhesus monkeys of infectious material originally obtained from an individual who had died at St. Louis during the 1933 epidemic of encephalitis, Armstrong and Lillie (1934) obtained a previously unidentified virus which in rhesus monkeys caused round-celled infiltration of the meninges and choroid plexus. The disease was, therefore, designated lymphocytic choriomeningitis, the virus being quite distinct from that of St. Louis encephalitis. Later, Armstrong and Wooley (1935) obtained two other strains of the same virus, one from a woman who had died from an undiagnosed nervous affection, the other from a monkey which had been inoculated with the virus of poliomyelitis. These three strains were immunologically identical and gave rise to similar pathological changes.

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<sup>1</sup> Officer commanding a Mobile Bacteriological Laboratory.

not only in monkeys but in mice, which also showed infiltration of the meninges and choroid plexus with lymphocytes. Almost at the same time Rivers and Scott (1935) obtained the virus of lymphocytic choriomeningitis from the cerebrospinal fluid of two laboratory workers. Shortly afterwards the virus was isolated from cases in England (Findlay *et al.*, 1936) and later in France.

#### CLINICAL SYMPTOMS.

For some time, cases of meningitis of unknown ætiology had been described under a number of names such as serous meningitis, acute aseptic meningitis, or acute benign lymphocytic meningitis. In 1924, Wallgren suggested that these were all names for one and the same disease. With the isolation of the virus of lymphocytic choriomeningitis it was believed that the causal agent of acute lymphocytic meningitis had been discovered. Further observations, however, have shown that not all cases of lymphocytic meningitis are caused by the virus of lymphocytic choriomeningitis, and that the clinical signs may vary from those of a mild febrile disease without nervous involvement to symptoms pointing to interference with the function of both cranial and spinal nerves. Thus Findlay, Alcock and Stern (1936) isolated the virus from the cerebrospinal fluids of two patients who showed considerable residual paralysis, one still having weakness in the legs more than a year after the onset of his illness. Hammis (1938) noted psychotic changes with delusions and hallucinations, Skogland and Baker (1939) headache, generalized weakness, nervousness, tinnitus, epigastric distress and disturbance of balance, and MacCallum and Findlay (1939) symptoms suggestive of poliomyelitis. Another patient developed obliterative arachnoiditis (Barker and Ford, 1937), while Viets and Warren (1937) and Machella, Weinverger and Lippincott (1939) reported fatal cases. On the other hand, Lépine, Mollaret and Kreis (1937), as the result of injecting the virus into a number of patients with cerebrospinal syphilis, found that only half developed signs of meningitis, the others suffering from a mild influenzal-like infection with moderate prostration. The general rule was for a febrile to be followed by an apyrexial period; only in those cases in which nervous symptoms developed was there a second period of fever. The virus could be detected in the spinal fluid of those cases that developed meningitis several days before the rise in the number of lymphocytes, but had disappeared some time before the cell count became normal. Virus was present in the blood from the onset of fever and disappeared usually at the end of the second or third week. It has not been detected in the saliva but is found in the urine of man (Lépine and Sautter, 1938).

In the blood, Mollaret, Lépine and Kreis (1939) noted during the first febrile and apyrexial phase a leucopenia followed by a lymphocytosis and mononucleosis, often associated with a relative eosinophilia. These changes disappeared with the onset of meningitis and renewed fever.



## CASE HISTORY.

The following case presents certain interesting features :—

*Clinical history and transmission to guinea-pig in France.*

Pte. H. R. had completed a course of treatment with sulphapyridine for urethritis as an in-patient in a ward where intercurrent respiratory infections were occurring, and was about to be discharged when he suddenly became ill and showed signs of meningitis. He was transferred to a casualty clearing station where he complained of headache and vomited repeatedly. There was a temperature of 102° F. with a pulse of 80, the neck was found to be stiff, and Kernig's sign was positive. No other abnormal neurological signs were found. There was a very scanty urethral discharge which showed neither leucocytes nor gonococci. Lumbar puncture produced a faintly turbid fluid containing 500 leucocytes per c.mm., of which 50 per cent were lymphocytes and 50 per cent polymorphonuclear cells. Cultures were sterile and no organisms were seen in films of the centrifuged deposit. The blood showed a leucocyte count of 10,000 per c.mm. with a normal differential distribution. Treatment was carried out with sulphanilamide as the patient had been receiving sulphapyridine up to three days before admission. Clinical improvement was slow and there was a diphasic fever for three days, followed by a gradual settling of the temperature by the seventh day. Vomiting and headache continued for some days and convalescence was not established until the tenth day, when blood was removed and serum separated. A second lumbar puncture on the second day after admission gave similar findings to the first and the cerebrospinal fluid showed 700 cells with 60 per cent polymorphonuclear cells on this occasion.

0.2 c.c. of the first specimen of cerebrospinal fluid was inoculated intracerebrally by one of us (S.-H.) into a young guinea-pig kindly supplied by the Director of a Pasteur Institute. The animal showed a rise of temperature to 103.8° F. on the sixth day and on the eighth day had lost weight and was sick with rough fur, laboured breathing, and a temperature of 104.3° F. It was killed on the ninth day and at autopsy scattered purplish-brown patches of consolidation were found in both lungs which closely resembled the areas of atelectasis seen in the lungs of mice infected experimentally with influenza virus. The brain was slightly congested. Portions of brain and lung were put in 50 per cent glycerine-saline and kept in a refrigerator for fourteen days before transmission to the Wellcome Research Institute, together with the patient's serum, and with these materials inoculations were made in England into mice, guinea-pigs, and a rhesus monkey.

The patient's serum was inoculated intracerebrally into two guinea-pigs in doses of 0.05 c.c. The first guinea-pig showed a rise of temperature to 104.5° F. on the seventh day after inoculation and remained between 104.0° F. and 105.7° F. during the next eight days. The temperature then sank to 97° F. and the guinea-pig was killed when very weak. The animal had become emaciated and at death the lungs showed considerable areas of

consolidation. The second guinea-pig's temperature rose to 104·8° F. on the sixth day. It was killed five days later when weak and emaciated; post-mortem the lungs were consolidated. Blood removed from both animals on the first day of fever was bacteriologically sterile and inoculated intracerebrally into mice, which died with spastic paralysis symptoms typical of lymphocytic choriomeningitis in six to nine days after injection. The brains of both guinea-pigs removed post-mortem produced lymphocytic choriomeningitis symptoms on intracerebral injection into mice and on subcutaneous injection of guinea-pigs. The original guinea-pig's brain was inoculated intracerebrally into a rhesus monkey, which showed a rise of temperature eleven days after injection and died suddenly on the thirteenth day. The brain inoculated intracerebrally into a guinea-pig produced fever, emaciation and death, and inoculation of the guinea-pig brain into mice produced death with symptoms of lymphocytic choriomeningitis. Of 12 mice inoculated intracerebrally with the original guinea-pig brain two died, while three others were subsequently immune to intracerebral inoculation with the virus of lymphocytic choriomeningitis.

The lung of the original guinea-pig was injected intracerebrally into two guinea-pigs, which showed fever on the seventh and thirteenth days respectively after inoculation; at death, areas of consolidation were present in the lung. Blood and brain from these guinea-pigs were bacteriologically sterile and on subcutaneous injection into guinea-pigs caused similar symptoms to those already described; on intracerebral injection of mice spastic paralysis and death occurred in from six to nine days.

Mice immune to an English strain of lymphocytic choriomeningitis virus were inoculated intracerebrally with the R strain and failed to develop symptoms.

The lesions produced in mouse and guinea-pig brains by the R strains of virus consisted of mild meningeal infiltration with marked involvement of the choroid plexus, changes identical with those caused by other strains of lymphocytic choriomeningitis.

The virus isolated from the guinea-pig material received in England and that obtained from the patient's own serum appeared to be immunologically identical.

The fact, therefore, that the virus of lymphocytic choriomeningitis was isolated from the patient's blood-serum and cerebrospinal fluid in two separate laboratories leaves little doubt that the patient was infected with this virus, which was the cause of his meningitic symptoms.

#### METHODS OF TRANSMISSION.

The first clue as to the means of spread of the disease was due to the finding by Traub (1935) that a stock of laboratory mice in America were infected with the virus. Later, Findlay, Alcock and Stern (1936) reported that the virus was present in mice in Great Britain, while Lépine and Sautter (1936)

similarly found laboratory mice infected in France. Since then evidence has been brought forward of the presence of the virus in Ireland (Collis, 1935), North Africa (Laigret and Durand, 1936), and Japan (Kasahara *et al.*, 1937). Once strains of mice have become infected, they may harbour the virus for many years. Thus Traub (1939) records continued infection in a mouse colony for four years, while in England a strain of mice has retained the virus for more than five years. In mouse colonies infection may be transmitted either *in utero* or by direct contact. These observations suggest that the virus may be the cause of an enzootic among mice and that from mice infection may be transmitted to man. Support for this view is provided by the observation of Armstrong and Sweet (1939) that wild mice were found infected in two houses in which cases of lymphocytic choriomeningitis had occurred. In addition, the virus of lymphocytic choriomeningitis is excreted in the urine of mice while, as shown by Findlay and Stern (1936) in the case of mice and monkeys, findings confirmed by Dalldorf (1939), for monkeys, and Shaughnessy and Milzer (1937), and Shaughnessy and Zichis (1939) for guinea-pigs, the virus may pass through the lightly scarified skin or even through the apparently normal skin. If the skin forms the portal of entry for the virus of lymphocytic choriomeningitis, the disease has certain analogies with leptospiral jaundice, where also the infective agent *Leptospira icterohæmorrhagiæ* is excreted in the urine of rats and infects through small abrasions of the human skin.

In the case of lymphocytic choriomeningitis, however, other possible means of transmission must be considered. At least one institutional outbreak has been described in America (Gilliam, 1938, and Wooley *et al.*, 1939), while MacCallum and Findlay (1939) isolated the virus from the nasal washings as well as the cerebrospinal fluid of a patient. There was no evidence that the patient, H. R., had been in contact with wild mice, but respiratory infections had been occurring in the ward in which he was confined when he developed meningitis.

In a spontaneous outbreak involving monkeys in the laboratory animal house, infection of two rhesus monkeys was traced to the fact that hay and sawdust which had been in contact with infected guinea-pigs had fallen into the monkeys' cages. In the case of a laboratory worker described by Lépine and Sautter (1938), the virus entered through the conjunctiva. It is, therefore, possible that the virus may be transmitted directly from man to man by droplet infection, the portal of entry being the mucosa of the nasopharyngeal tract or through the conjunctiva.

A third possibility is that infection may, under certain circumstances, be transmitted by biting arthropods which take up the virus as it circulates in the peripheral blood-stream. Coggeshall (1939) for instance, found that *Aedes aegypti* was able to transmit infection by bite from monkey to monkey for from four to fourteen days after feeding on an infected monkey, while Shaughnessy and Milzer (1939) obtained infection with the excreta of the tick *Dermacentor andersoni* Stiles. Preliminary experiments with lice,

*Pediculus humanus* var. *corporis*, have shown that after feeding on an infected monkey these arthropods may retain the virus for at least some hours as shown by their capacity to infect guinea-pigs when ground up and injected subcutaneously. Normal lice of the same strain, for which our thanks are due to Prof. P. A. Buxton, caused no symptoms when similarly injected in guinea-pigs.

The most probable method of infection would seem to be from mouse to man through abrasions of the skin or mucous membrane ; in view, however, of the occurrence of institutional or small familial outbreaks, the possibility of direct transmission from man to man cannot be ruled out.

Although the available evidence points to the mouse as the chief source of the virus, there is a suggestion that certain other animals may act as a reservoir. Dogs, when injected intracerebrally with lymphocytic choriomeningitis virus, show no symptoms although they subsequently become immune (Findlay and Stern). In 1937, Dalldorf, Douglass and Robinson in America, found that certain specimens of canine distemper vaccine prepared from dog spleens caused a fatal infection when injected intracerebrally in rhesus monkeys ; later (Dalldorf, 1939,) it was found that the fatal infection was due, not to the virus of canine distemper, but to that of lymphocytic choriomeningitis, the virus of which had been present in the dogs' spleens. Unpublished observations have shown that in England also pooled sera from dogs may occasionally show the presence of immune bodies to lymphocytic choriomeningitis, while on one occasion the virus was actually isolated from the spleen of an apparently normal dog. Efforts to show the presence of immune bodies in the serum of cats or to isolate the virus from cats' spleens have so far proved negative.

#### DIAGNOSIS.

In view of the wide range in symptomatology varying from a mild influenzal syndrome to one closely simulating poliomyelitis which can be produced in man by the virus of lymphocytic choriomeningitis, clinical diagnosis is of comparatively little value. The disease must be borne in mind as a possibility in cases clinically resembling meningococcal meningitis. However, the examination of the cerebrospinal fluid often reveals changes which may be of use in diagnosis. The fluid is usually slightly turbid and under increased pressure. At the peak of the infection there are as a rule about 500 to 1,500 cells, predominantly lymphocytes, per c.mm. The protein content is raised and the sugar lowered in a typical case. The fluid is bacteriologically sterile.

The most reliable method of diagnosis consists in the isolation of the virus from the blood or cerebrospinal fluid by injection into mice or guinea-pigs.

In cases where the acute symptoms have passed, three laboratory methods of diagnosis have been employed. These methods are :—

- (1) Demonstration of virucidal immune bodies.
- (2) Complement fixation.
- (3) Precipitin tests.

Neutralizing antibodies in the blood-serum are not always present in high titre, though they may persist for a considerable period. Armstrong and Wooley (1937) found specific neutralizing antibodies in 11 per cent of 1,248 normal sera, in 32 per cent of sera from persons who had a history of acute aseptic meningitis and in 28 per cent of sera of persons recently recovered from an upper respiratory infection. These data lend support to the view that the virus may be of greater importance as a cause of human infection than the occasional cases of involvement of the central nervous system would indicate.

Complement fixation was first attempted by Howitt (1937), and has since been extensively employed by Lépine, Mollaret and Sautter (1938), and by Smadel, Baird and Wall (1939). The antigen most commonly employed is made from the lung or spleen of guinea-pigs dying of the disease. More recently Smadel, Baird and Wall (1939) have employed as antigen a soluble specific factor obtained from infected guinea-pig spleen. With this soluble specific factor and immune serum, Smadel, Wall and Baird (1940) have been able to obtain a specific precipitin reaction.

#### THE CONTROL OF LYMPHOCYTIC CHORIOMENINGITIS.

From what has been said of the possible means of spread of the disease, it is obvious that precise steps cannot be laid down for its prevention.

In view, however, of the presence of the virus in the urine of mice, steps should be taken to keep down the number of these rodents in all buildings occupied by large numbers of men. All cases of non-bacterial meningitis, with lymphocytes in the cerebrospinal fluid, should be regarded as possible sources of infection.

Specific immunization with formolized virus was attempted by Traub (1938). A vaccine prepared from infected guinea-pig lung tissue immunized guinea-pigs, but vaccines from infected mouse tissue were incapable of immunizing guinea-pigs owing to the presence of an excess of foreign antigen. More promising results have been obtained with formolized vaccine prepared from virus grown in a serum Tyrode mixture containing chick embryo tissue.

Neither prontosil rubrum nor sulphanilamide has any curative action in man, although in experimental infections in mice certain observers have claimed that prontosil rubrum has a slight effect in large doses when the infective dose of the virus is small.

The fact that the patient, whose case is here described, had been treated with sulphapyridine immediately before the onset of his nervous symptoms, may be taken as evidence that this compound is also of little value in the treatment of lymphocytic choriomeningitis.

# CONCLUSION.

A case of lymphocytic choriomeningitis is described. The diagnosis and method of spread of the disease are discussed.

The clinical details of the patient, H. R., were kindly supplied by Major G. R. McNab, F.R.C.P.Edin., R.A.M.C., Medical Specialist to a casualty clearing station.

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## THE TREATMENT OF GENERAL PERITONITIS FOLLOWING ACUTE APPENDICITIS.

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ACUTE appendicitis continues to cause too many deaths. Grey Turner, in a series of 2,391 cases, gives a total mortality of over 3 per cent. For cases complicated with flank or pelvic peritonitis, he gives a mortality of 8·9 per cent, while with diffuse peritonitis the figure rises to over 29 per cent. These figures are from his own practice ; in less skilful hands they are undoubtedly much higher. Every effort should therefore be made to find some means of reducing this waste of life, so often in its prime. I propose to devote this paper to the treatment of the gravest complication of acute appendicitis, general peritonitis.

General peritonitis, the main cause of death in acute appendicitis, may kill either directly or by its sequelæ, paralytic ileus and intestinal obstruction. Particularly in the very young and the old general peritonitis is apt to be a deadly complication.

Peritonitis results when the bacterial flora of the appendix pass through its devitalized wall to enter and proliferate in the peritoneal cavity. This may happen before the appendix perforates, in which case the peritonitis is early of onset and often generalized from the beginning. Fluid is poured out by the peritoneal cells and soon becomes purulent. Case 1 (*see later*) was an example of this type. More often, however, the gangrenous appendix becomes surrounded by omentum, the peritonitis remaining localized until perforation occurs, when it either becomes generalized or may be still partly localized to a flank or pelvic peritonitis. If the omentum manages to keep the infection localized to the vicinity of the appendix, an appendical abscess results. Although careful packing off of the abdomen will minimize it, spread of infection is inevitable at operation, after which the case must be regarded and treated as one of general peritonitis. An exception is the late appendical abscess already walled off and pointing, and opened only to admit a drain tube so that the infection does not spread. The point made though is important enough to be repeated : all cases of localized peritonitis with pus formation have become generalized as far as the spread of the organism is concerned by the end of the operation for appendicectomy, and must be treated accordingly.

The time after which general peritonitis follows appendicitis is very variable. In many mild cases resolution will occur without it ever following ; others will remain localized until the abscess formed points. Then on the other hand there are those fulminating cases where general peritonitis comes

on very early. These, often very deceptive, constitute the danger of any delayed treatment in appendicitis. Usually, however, there is a respite of some hours during which the surgeon, if he sees the cases in time, can operate before the appendix has perforated.

The most important factor then in the prevention of peritonitis is immediate operation in all cases of appendicitis. Let the surgeon remember that it is highly probable that any abdominal pain persisting unabated for over four hours is surgical, and of itself an indication for exploratory laparotomy unless there is another very obvious cause. Let the non-surgeon remember that any pain in the mid or lower abdomen should be suspected as appendicitis until proved otherwise and referred for surgical opinion. If these rules are remembered, that repeated question, "Do you think it has burst, Doctor?" could be more reassuringly answered. Personally, I only consider one treatment for acute appendicitis, and that is operation as soon as the patient can be got to the theatre. The Ochsner-Sherren treatment, carried out in a ward next to the theatre by an experienced surgical team, may have minor advantages in carefully selected cases, but under ordinary circumstances it is asking for trouble.

And beware of the soft abdomen! Occasionally with well-advanced general peritonitis the rigidity may be surprisingly little. I am not likely to forget the first time I was caught over this. As a Resident Medical Officer at the Melbourne Hospital, I was once called up at 2.30 a.m. to see a man admitted as acute appendicitis. His pain had begun about four hours previously, but half an hour before had eased off considerably. His pulse and temperature were only slightly raised, and his abdomen, though tender over the appendix, was quite soft. I decided he could wait until the morning and put him down for 8.30 a.m. At operation his abdomen was full of pus he had had for hours. The easing-off of his pain was, of course, the result of gangrene and not improvement. He died of paralytic ileus about the sixth day. This lesson made all the difference to a case soon after I arrived in India. The surgical specialist asked me to look at a doubtful abdomen which he proposed to watch for a while. The case was almost identical, with just the slightest abdominal rigidity. I said I thought he had general peritonitis, and at operation half an hour later, his abdomen was full of yellow pus. He made an uneventful recovery. The "soft abdomen" case is very much of a snare for the unwary.

Now let us consider the problem of general peritonitis from the point of view of formulating a rational line of treatment. We have a small gangrenous hollow viscus lying within the peritoneal cavity, its lumen continuous with the bacteria-laden cæcum. Various organisms are liberated, coliforms, anaerobes, and streptococci being the commonest. On the defensive side we have the omentum trying to wrap itself round and localize the lesion and the defensive powers of the peritoneal cavity itself, than which no structure in the body is better capable of dealing with infection.



## 18 *Treatment of General Peritonitis Following Acute Appendicitis*

It was J. B. Murphy (of "Murphy's button" fame) who, at a British Medical Association meeting in Toronto some thirty-odd years ago, first described a rational treatment of general peritonitis, which was to change completely the prognosis in these cases. Briefly, his method was the adoption of Fowler's position, drainage of the pelvis and the continuous slow administration of normal saline *per rectum* (the "Murphy's drip" method). The point about drainage will be discussed later, but his results spoke for the great value of this revolution in treatment.

The rational sequence, then, for attacking the problem of general peritonitis may be summarized as follows: (1) Remove the source of infection, and do it in the minimum time possible; (2) remove as far as possible the debris of the fight (pus, etc.) found at operation; (3) then give the peritoneum its optimum chance of fighting the invading organism by putting the patient into Fowler's position and ensuring complete and absolute rest; (4) directly attack the invading organism by any specific means possible; (5) keep the patient supplied with the fluid and chlorides he badly needs, and carefully watch the general condition so as to be able to meet any special need which may arise. Remember circulatory failure is not necessarily fatal if treated promptly.

*The Operation.*—In every sense this must be an immediate operation. Every minute delayed increases the risk to the patient. I usually give an adult patient morphia  $\frac{1}{3}$  grain as soon as I have made the diagnosis. If the patient has to be moved any distance to hospital, or if there is likely to be any delay, it should be increased to  $\frac{1}{2}$  grain. Complete removal of the gangrenous appendix is essential, and offers the patient his best chance by far. It is much better to take a little longer and get the whole appendix out than to put in a drain tube and trust to luck. Luck is usually out in these cases and it is a confession of surgical failure. The time factor is most important, and not a minute should be wasted during the operation. As the removal of a deeply buried gangrenous appendix, surrounded by thickened omentum and adhesions, can be anything but easy, and must be performed very gently and carefully, this means that opening and closing the abdomen must be done with all possible speed so as to save the limited time for the actual handling of the appendix. Murphy's golden rule in these cases was "quick in and quicker out." It makes all the difference to the patient. I prefer the muscle-splitting incision except in odd cases where the diagnosis is doubtful. There is usually no point in trying to bury the appendical stump unless it can be easily done. It is often difficult to perform as the sutures cut out from the oedematous caecal wall and the attempt, which wastes a lot of valuable time, may do more harm than good. If tied off it can be safely left, and in the presence of general peritonitis is a mere drop in the ocean.

The peritoneal cavity should be sucked or mopped dry, not forgetting to swab down into the pelvis where the last of the fluid collects. Flushing out the peritoneal cavity has fallen into disfavour. It rarely does much

good, and in any case should never be done with anything stronger than normal saline.

The appendicectomy completed and the abdomen mopped dry, the peritoneum is then closed without drainage. The rest of the wound is washed, first with saline, then with flavine, and closed as quickly as possible with the minimum of sutures. I put a small glove drain down to the rectus sheath, as wound infection with such cases is the rule rather than the exception. An anchor dressing stops any tendency for the skin vessels to bleed and means that any but large vessels can be twisted off without tying.

Drainage of the peritoneal cavity is to be condemned. Although a minority of surgeons still favour it, it is an obsolescent form of treatment and usually serves no useful purpose. Once the focus of infection has been removed, the issue is now a battle between the pathogenic organisms free in the peritoneal cavity and the peritoneum. The striking ability of the peritoneum to deal with infection is well known. If the virulence of the organism is so overwhelming that the resistance of the peritoneum is overcome, no number of drain tubes will save the patient. If, on the other hand, the peritoneum is capable of dealing with the infection once the focus is removed, a drain tube is unnecessary and only does harm. In any case the tube, itself an irritant, tends to be quickly shut off with omentum so as to become ineffective. It then only serves as a path for more infection from outside.

Without drainage the peritoneum can usually manage to overcome the infection and the purulent peritoneal fluid is absorbed. Less often a localized abscess is formed which, with the patient in Fowler's position, collects in the pelvis, where it can be later opened through the rectum or vagina.

Drainage, therefore, is indicated only in two circumstances :—

(1) If for some reason the surgeon is unable to remove the appendix or the patient is too desperately ill to stand anything but the most rapid operation, a tube to the appendix through a stab in the loin offers the only hope.

(2) In the cases of appendical abscess seen late, where the abscess has already started to point through the abdominal wall, a drain tube, introduced through a small slit incision with the minimum interference, is the best treatment. The appendix can be removed six months later.

The abdominal wall, however, should always be drained. It helps to prevent wound infection.

The patient is returned to bed with the usual hot bottles, etc. He should be laid flat and not put into Fowler's position until well out of his anæsthetic. At least two pints of saline should be given immediately while he is still unconscious, either rectally or better subpectorally. When consciousness returns, the patient should be put into high Fowler's position, given continuous rectal saline by the drip method, and the morphia treatment begun.

## 20 *Treatment of General Peritonitis Following Acute Appendicitis*

*The Morphia Treatment.*—Morphia is a life-saving drug in general peritonitis. The object of the treatment is to morphinize completely the patient and keep him so until his peritonitis has subsided. As previously stated the issue, once the gangrenous focus has been removed, is that of a battle between pathogenic organisms in the peritoneal cavity and the lining cells of the peritoneum. In order to give the peritoneum its maximum advantage in this fight, complete rest, both of the bowel and the body generally is essential. Morphia alone can do this. With it, pain is almost absent and the patient dozes most of the time. The restless tossing of a pain-wracked patient, unable to sleep, which does so much to exhaust and kill, is thus eliminated to the benefit both of the patient and his attendants. In Case 6 morphia was stopped against my orders. He collapsed after a very restless night. The properly morphinized patient has contracted pupils and respirations reduced to 10 to 14 per minute. The dose should be arranged so that he is never in pain but dozes all day, though answers questions readily when roused.

I have found an amazing prejudice against giving morphia like this. After the first day the nursing staff usually weaken and want it stopped. If matron does not attempt to, the night sister is sure to try. The usual excuse is "He seemed so comfortable that I did not give it," or "He was asleep at the time for his injection." I think they suspect me of attempting euthanasia.

The best way to ensure that the patient receives his morphia is to have a special chart drawn up and each dose initialled as it is given.

Morphia  $\frac{1}{4}$  grain every four hours is usually sufficient for an adult patient, though more may be needed for a start. Later it may be possible to reduce the dose. It should be given day and night irrespective of whether the patient is awake or asleep. Morphia is stopped as soon as there is no evidence of peritonitis, usually by the third or fourth day. There is no danger of habit-formation under these circumstances.

*Drug Treatment.*—The introduction of the sulphanilamide group of drugs gives a new weapon worth trying in these cases. As streptococci and coliforms are common invading organisms in peritonitis, the inhibitory action of these drugs on such organisms may be a valuable aid to the patient's defence. Sulphanilamide appeared to help Cases 4 and 5. I propose to use these drugs in full doses in future.

*Serum Treatment.*—Hamilton Bailey advises injecting antigas-gangrene serum into the abdominal cavity before the peritoneum is closed. I did this in Cases 4 and 5. It is worth trying and certainly does no harm.

*Feeding the Patient.*—Until the peritonitis has subsided and the bowels open, no solid food should be given. 10 per cent glucose, solution flavoured with lemon or orange juice, and broth alone are given, as much as the patient can take.

*Dangers after Operation.*—The two main dangers to be watched for are early circulatory failure within the first few days and paralytic ileus.

Patients with general peritonitis, specially old or very young patients, are liable to sudden collapse. Pain and restlessness (*see* Case 6) are important factors in bringing this on ; hence the value of morphia. The pulse becomes rapid and almost imperceptible at the wrist, the extremities become cold and the respirations short and rapid, the clinical picture closely resembling shock, a form of which it is. The treatment, which must be prompt if the patient is to be saved, is that for shock. If left in Fowler's position he will die. He must be laid flat and the foot of the bed raised on blocks. The risk of subphrenic collection has to be taken—better a subphrenic abscess to deal with later than a dead patient. He is packed with hot bottles or an electric cradle and given continuous slow intravenous saline.

Coramine in repeated doses is useful. The patient usually responds fairly rapidly to this treatment but should not be put back into Fowler's position until twenty-four hours later, though it is unnecessary to keep the foot of the bed raised once the pulse recovers. Case 3 responded dramatically to this treatment. In Case 6 it was not given until too late.

Paralytic ileus is the greatest danger following peritonitis. It usually occurs on the third day. The picture is a combination of intestinal obstruction and toxæmia. The abdomen becomes distended and silent, and an enema produces little or no result. Vomiting begins, typically a dirty brown fluid, though rarely truly faecal. The pulse-rate rises and its tension falls. Respirations increase and the extremities become cold, often clammy. There is restlessness and thirst and a dry brown tongue.

Here again America has given us a method of treatment which has entirely changed the prognosis in these cases. Wangenstein in 1933 published an account of a treatment he had evolved which, like Murphy's contribution thirty years earlier, has saved many lives. Briefly, it consists of continuously draining the upper part of the alimentary canal by a duodenal tube, at the same time replacing the fluid lost by continuous slow intravenous infusion of normal saline. This continues until the bowel regains its tone ; it may take hours, it may take days. The patient lies flat on his back in bed but is allowed two pillows. A soft duodenal tube with several lateral openings is passed into the stomach via the nostril and the stomach contents aspirated. The tube can be allowed to pass on into the duodenum or else just remain in the stomach according to the length. It is strapped to the face and aspiration is carried out at hourly intervals. An excellent aspirator is the large bottle and suction syringe used for aspirating pleural effusions. After each aspiration the patient is allowed a little glucose lemon drink or broth, but no solid fluid. The slow intravenous saline is best given via a vein at the ankle. Under this treatment the vomiting ceases and the distension soon becomes less. The tube is left in until the bowels open, which may take days.

The fluid output (vomit, urine, etc.) is carefully charted, and the saline given intravenously is graded so as to more than balance this. The rapid improvement in the patient's circulation usual in such cases is due to this

## 22 *Treatment of General Peritonitis Following Acute Appendicitis*

restoring of the body fluid and chlorides. If severe circulatory collapse occurs during the treatment, the addition of a drug such as neo-synephrin (Stearns) to the infusion of saline may be life-saving.

Less serious and much more common is distension prior to the bowels opening. Provided there is no distension, I never worry unduly about a bowel action, though I must confess I am happier when they have acted. When distension begins, however, it is time to get the bowels open or the case may pass on to paralytic ileus. An enema and large fomentations to the abdomen are usually effective. In one case (Case 3), when paralytic ileus was impending, hourly injections of 0.1 gramme acetylcholine bromide (a parasympathetic stimulant) combined with a rectal tube produced first flatus then a bowel action after three hours.

Two other complications must be mentioned in conclusion. Pelvic abscess, indicated by a swinging temperature after the first week, is not serious and can be opened rectally or vaginally after fourteen days. Sub-phrenic abscess is not common after appendicitis. It is difficult to diagnose and should be suspected in the presence of a swinging temperature with no other obvious cause. X-ray and an exploratory needle through the diaphragm will confirm the diagnosis. It is best drained by the transpleural approach through the diaphragm.

### CASE REPORTS.

*Case 1.*—B. T., girl, aged 14. History of abdominal pain for five hours, first umbilical then settling in right iliac fossa. Nausea but no vomiting. Pulse 80, temperature 100° F. Marked tenderness and hyperæsthesia over appendix but only slight rigidity. At operation free non-purulent fluid was present in abdominal cavity and a thickened appendix becoming gangrenous was removed. Closed without drainage and she was put on morphia which was discontinued the next day. Her recovery was uneventful and she was allowed up on the seventh day. This case was caught in the very early stage of general peritonitis, before the peritoneal fluid had become purulent. The appendix had not perforated.

*Case 2.*—W. H., male, aged 22. History of acute abdominal pain for twenty-four hours, at first umbilical then settling in right iliac fossa. Nausea and vomiting. Had taken castor oil and had a bowel action. Pulse 96, Temperature 100.2° F. Rigidity and tenderness of lower abdomen maximal over right iliac fossa. No hyperæsthesia. At operation a gangrenous retrocæcal appendix was removed. It had perforated at the base over a faecolith. Pus was present in right iliac fossa and pelvis, which was swabbed dry. Abdomen was closed without drainage and the patient put into full Fowler's position (after his return to consciousness) and given continuous rectal saline. Morphia  $\frac{1}{4}$  grain was given four-hourly until the fourth day. The temperature was down by fifth day and further convalescence was uneventful.

*Case 3.*—I. R., girl, aged 8. History of abdominal pain for three days.

Vomited at onset. Temperature 101° F., pulse 120. Marked tenderness in right iliac fossa but no true rigidity. At operation (a right paramedian incision was used in this case) a perforated gangrenous appendix was found in the retrocolic position, with a localized collection of foul-smelling pus. This was mopped dry and the appendix removed. A drain tube was put from the rectocæcal space through a stab in the flank, because I was doubtful about some of the adjacent omentum. It served no useful purpose and was removed the next day. The abdomen was closed and the patient put on morphia  $\frac{1}{8}$  grain every four hours and into Fowler's position on recovery from the anæsthetic. Fourteen hours later I was called urgently to find her collapsed and shocked, with a scarcely palpable pulse. After prompt restorative measures (raising foot of bed, hot bottles, rectal saline) she improved considerably, and by next day was fit to put back into Fowler's position. Two days later she developed abdominal distension with no result from enemas. 0.1 gramme acetylcholine bromide was injected and repeated at hourly intervals. After an hour she passed flatus through a rectal tube, and after three hours her bowels opened. Subsequent convalescence was uneventful, except for some minor wound infection.

*Case 4.*—P. B., girl, aged 10. History of severe, mid-line, lower abdominal pain for nine hours. She had been given castor oil, but had vomited it. Her mother, of low mentality, had made her walk a quarter of a mile to my Medical Inspection Room, and thought she had something wrong with her hip because she limped! She had generalized abdominal rigidity maximal over the right iliac fossa, where there was special tenderness. Temperature 100° F., pulse 88.

At operation the abdominal cavity was full of semipurulent fluid. A gangrenous perforated appendix was removed. The abdomen was mopped dry and closed without drainage, leaving behind 10 c.c. anti-Welchii serum. 5 c.c. of soluseptasine was given intramuscularly and morphia  $\frac{1}{8}$  grain every six hours (she had morphia  $\frac{1}{4}$  grain prior to operation). Rectal saline was begun and she was put in the high Fowler's position. By the third day she was much better, with her morning temperature down and her abdomen quite soft. Morphia was stopped. Castor oil that evening produced a bowel action. Her subsequent convalescence was complicated only by a wound infection in the second week.

*Case 5.*—H. L., Sepoy, aged 30. Gave a history of abdominal pain of sixty hours' duration (his medical attendant thought he had malaria). He had generalized abdominal tenderness and rigidity maximum over right iliac fossa. Temperature 103° F., pulse 106.

At operation a foul-smelling general peritonitis was present, the smell suggesting *B. coli*. In the darkish peritoneal fluid floated flakes of lymph and sloughed appendix. The bowel was red and acutely inflamed. His appendix, which was gangrenous to the base and partly sloughed away, was removed, the abdomen mopped dry and closed without drainage, leaving behind 20 c.c. antigas-gangrene serum. He was given continuous rectal

## 24 *Treatment of General Peritonitis Following Acute Appendicitis*

saline, morphia  $\frac{1}{4}$  grain every four hours, and 5 c.c. prontosil soluble three times daily. By the third day his abdomen was soft and he was taking fluids by mouth freely. His bowels opened on the fifth day following calomel on the night before and morphia was discontinued. He now developed a foul wound infection with evening temperature. By the fourteenth day his wound was clean, but he still ran an evening temperature. At this stage jaundice of his conjunctivæ was noticed. He died of suppurative pylephlebitis of the liver just six weeks after the operation. Sulphanilamide had no effect.

*Case 6.*—Hindu boy, aged 12. History of five days' abdominal pain and vomiting. He was brought to hospital because of his leg, being unable to extend his right thigh for abdominal pain. He had marked abdominal tenderness and rigidity, maximum over right iliac fossa. Temperature 103° F., pulse 100. There was a retrocæcal gangrenous appendix, and a large collection of foul-smelling pus localized in the iliac fossa and pelvis. Appendix was removed, pus swabbed out, and the abdomen closed without drainage. He was put on morphia  $\frac{1}{4}$  grain every four hours, rectal saline and prontosil (two tablets three times a day). The next day his condition was good. I arrived on the morning of the third day to find a cold, pulseless, moribund boy still propped up in Fowler's position. They told me he had collapsed four hours previously after a restless night, but they had done nothing about it. Morphia had been discontinued the day before against my orders. I gave him full treatment for shock immediately, but he died two hours after. His blood Wassermann, taken by the Indian house surgeon for some reason known best to himself, was returned strongly positive.

### COMMENTS ON CASES.

Of the six cases, five recovered from their peritonitis. Case 5 died later, but not of peritonitis. Case 6 was in some respects not a fair test, as the morphia treatment was discontinued against my orders, and no attempt was made to treat his collapse until too late. His chances were not improved by the fact that he was syphilitic. They all illustrate the danger of delay in surgical treatment.

I wish to thank Colonel C. D. K. Seaver, V.H.S., officiating D.D.M.S. Southern Command, India, for permission to send this article for publication.

## DUTIES OF A QUARTERMASTER'S DEPARTMENT IN PEACE.

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THIS article deals with the duties in a Quartermaster's Department in peace.

The duties might be summarized under the following general headings :—

(1) Charge of the buildings, quarters, barrack rooms and enclosures of a military hospital and company, R.A.M.C., and the fixtures contained therein.

(2) Arrangements for the supply and maintenance of, and the accounting for, all equipment, barrack, medical and ordnance.

(3) The indenting and accounting for : (a) Diets and extras ordered for patients in hospital ; and (b) rations for the R.A.M.C. personnel.

(4) The submission of indents for fuel and light, disinfectants, etc., and accounting for them.

(5) Hospital charges.

### (1) BUILDINGS, QUARTERS, BARRACK ROOMS AND ENCLOSURES.

All buildings, quarters, etc., are taken over from the Officer i/c Barracks by the Quartermaster on behalf of the O.C. and held on charge by the O.C. Unit. A statement of all the rooms, etc., contained in the barrack and hospital buildings is detailed on Army Form G. 1062. This form is made out in duplicate and signed by the O.C. Unit and the Officer i/c Barracks. One copy is kept by the O.C. Unit and the other by the Officer i/c Barracks, and the statements are verified annually. This verification takes place just before the Officer i/c Barracks carries out his annual inspection.

Regns. S.T.&B.  
Services 1930,  
para. 647.

Once the O.C. Unit takes over any building he is responsible for its care and maintenance and deals direct with the Garrison Engineer in this connexion.

Each room in a building or quarter is generally provided with an inventory of R.E. fixtures, and one of the duties of a Quartermaster, in so far as the hospital and barrack buildings are concerned, is to make a periodical inspection of them and where damages or deficiencies are noted to fix if possible individual responsibility. In a place like a military hospital where the occupants of the various wards and departments are continuously changing it is often impossible to fix the blame on any particular person.

Regns. E.S.  
1930, paras. 246  
and 249.  
Regns. M.S.A.  
1935, para 327.  
S.O., R.A.M.C.  
1937, para. 127.

Where loss or damage can be traced the matter is reported to the Garrison Engineer on Army Form P. 1923 and the individuals are charged.

Regns. E.S.Pt.1,  
1930, para. 126.

It may be well to mention at this stage that as a general rule the occupants of War Department buildings are regarded as being in the position of tenants of a civilian landlord who expects all broken glass to be made good at the



Regns. E.S. Pt.  
1, 1930, para.  
122.

expense of his tenants. Glass is not replaced in War Department buildings at the public expense as a matter of course on the grounds of damage by storm, or that the persons who did the damage are unknown. Normally the unit must collect the cost from someone or suffer the loss.

On the other hand the regulations do relax to some extent in this respect ; for example, at some stations gales spring up with considerable force with little or no warning. Doors, windows and fanlights bang to and the electric lights swing about with consequent breakages of window panes and opal lamp shades. Doors and windows when open should, however, always be secured by the hooks and eyes which are generally provided for the purpose, so it is always difficult to get charges through on that score, but cases do arise when such breakages occur through unavoidable circumstances, and when this happens the matter is reported on Army Form K.1306 if urgent, or on Army Form K.1308 if not urgent, to the Garrison Engineer.

Regns. E.S. Pt.  
1, 1930, para 122.

On these forms the nature of the repair required is shown and a statement of the circumstances in which the damage occurred is given, the C.O. adding a certificate to the effect that he is satisfied that all reasonable precautions to prevent damage were taken, that is, windows, doors and jalousies were at the time properly fastened. If the Garrison Engineer agrees, all well and good, the damage is repaired at the public expense. Sometimes, however, he does not agree, in which case the C.O. has the right of appeal to headquarters.

Regns. E.S. Pt.  
1, 1930, para 122.

There are many losses and damages to R.E. fixtures in a military hospital which are not due to the elements and which, on the other hand, cannot be traced to individuals, and these have to form the subject of a proportionate charge against units whose sick have been treated in the hospital during the period in which the losses or damages took place.

These items are generally dealt with once a quarter and the procedure in brief is this :—

Particulars of the various losses or damages are given in detail on Army Form P.1923 and sent to the Garrison Engineer who carries out the replacement or repair and reports the cost to the O.C. hospital.

Regns. E.S. Pt.  
1, 1930, para 122.

The O.C. hospital (actually the Quartermaster) divides the cost amongst the various units concerned according to the number of their men who have been under treatment and sends the detail back to the Garrison Engineer who then sends it to the Garrison Adjutant and he notifies the units in garrison orders the amounts to be paid to the public.

So much for losses and damages. Now a few words on repairs.

There are two classes of repairs, namely normal and urgent.

Urgent repairs are reported immediately on Army Form K.1306 and are generally confined to repairs affecting water, gas, and electricity. There are exceptions to this ; for example if the key of the ward medicine cupboard is lost and the cupboard cannot be opened, then action has to be taken straight away. In this respect the Quartermaster has to use his discretion.

Normal repairs are reported monthly on Army Form K.1308 and the

repairs are carried out by the R.E. as and when the labour at their disposal permits.

The following are a few of the more important things to watch when taking over any class of building ; for example lavatory basins, water-closet pans, baths and sinks. These are expensive items which easily get damaged, so it is well to make sure that they are sound before taking over.

Keys are another source of trouble ; they are constantly getting lost, and, as it is difficult to fix the blame, it is as well to ensure that all locks have properly fitting keys. Yale locks are usually provided with three keys, and locks to stores generally have two. Duplicate keys for ordinary door locks are not provided. There seems to be a popular impression that the Quartermaster holds a duplicate key for every door, but this is not so. If the key to an ordinary locked door is lost the only thing the Quartermaster can do is to call in the help of the R.E.'s to open it, and this is usually managed by force.

A note should be made of broken or cracked window panes. Ensure that the individual from whom the building is taken over accepts responsibility for their replacement.

It may be found in taking over buildings, quarters, etc., that all the R.E. fixtures are not shown on the inventory boards, but only those which could easily be removed. Such items as sinks, lavatory basins, water-closet pans, water cisterns and pipes are not usually shown.

It may be interesting to know what can be done in the way of redecoration, for instance, to public quarters. The external painting of wood and iron work may be done every four years at home stations and every two or three years at stations abroad. Internal painting is normally done once in eight years.

In the case of a change in the occupancy of officers' quarters, internal painting up to one-eighth and external painting up to one-fourth of the total respective costs of these periodical services may be incurred for each year that has elapsed since they were last done.

In the case of all quarters, one coat of distemper may, if necessary, be applied on change of occupancy provided that not less than one year has elapsed since it was last done.

Rooms in which infectious diseases have occurred may (after disinfection) be redistempered and repainted on the certificate of an officer of the R.A.M.C. that the work is necessary.

In addition to the periodical inspection made by the Quartermaster, inspections are carried out by the Royal Engineers for the purpose of noting and carrying out maintenance services. The dates of these inspections are published in garrison orders.

There are actually two classes of R.E. Services, namely Capital Services, which comprise new works and additions, and Maintenance Services, which include repairs and periodical services.

These are further split up into Part I, Part II, and Part III Services.

Regns. E.S. Pt.  
1, 1930, Table  
"L."

Regns. E.S. Pt.  
1, 1930, para.  
118 (ii).

Regns. E.S.  
Pt. 1, 1930, para.  
1 (i) and (ii).

Generally speaking Part I deals with services costing £2,500 and upwards.

Part II deals with new works likely to cost less than £2,500. Under this heading it might be mentioned that in some commands the D.D.M.S. calls for a list of Part II Services which the O.C. wants carried out, and the items have to be put down in order of priority. As stated above, these comprise new works or additions, for example, additional buildings, additions to existing buildings, structural alterations to wards and departments.

Such demands are considered by higher authority, who may approve or not, as much depends on the urgency of the services and the availability of funds.

## (2) EQUIPMENT—BARRACK, MEDICAL, AND ORDNANCE.

This heading deals with the supply and maintenance of, and accounting for, all equipment, barrack, medical, and ordnance.

### (a) Barrack Equipment.

Barrack equipment includes furniture, linen, bedding, hospital clothing, fire appliances, electric bulbs, etc.

Regns. M.S.A.  
1938, paras. 325  
and 326.

All such equipment for use in a hospital or in barrack rooms is provided by the Officer i/c Barracks in accordance with the scales laid down in hospital or barrack schedules. Hospital schedules deal generally with the wards and various departments which go to make up a military hospital, and barrack schedules with such places as officers' and soldiers' quarters, messes, nursing sisters' quarters, churches, schools, libraries.

Regns. M.S.A.  
1938, para. 326.  
Regns. S.T. &  
B.S. 1930, para.  
641.  
Regns. S.T. & B.  
Ser. 1930, paras.  
652-658.

Each of the wards, departments, rooms, etc., in these places, is invariably provided with an inventory board, on which is shown the articles held on charge. In addition, in the case of hospitals, Army Book 126 A., more commonly known as the "long roll," is also maintained, and this is kept in the Quartermaster's office. A copy of this long roll is also held by the Officer i/c Barracks. This long roll is actually a complete inventory by wards and departments, of the whole of the barrack equipment held on charge by the hospital. No alteration can be made to the entries in the long roll or to the entries on the inventory boards except by the Officer i/c Barracks or his representative, and each alteration has to be initialled by one of them.

Regns. S.T. &  
B.S. 1930, para  
637.

Issues in excess of the scales laid down cannot be made without the approval of the G.O.C., and even then they are subject to review every six months.

Apart from the scale of stores allowed specifically for the various wards and departments of a military hospital, hospital schedule No. 24 gives a list of additional equipment which is allowed for the hospital as a whole. This equipment is held on charge in the linen store, and includes such items as linen and bedding, crockery and cutlery, patients' hospital clothing, measure glasses, hot-water bottles, and the various other articles which a ward needs to hold on loan according to its requirements.

In wards nursed by the Q.A.I.M.N.S. the matron takes over and is responsible to the Quartermaster for the whole of the bedding and equipment held on charge. A bedding book, A.B.54, is maintained, and this is signed monthly by the matron. Regns. M.S.A. 1938, paras. 223 and 224

The bedding and equipment in wards and departments not nursed by the Q.A.I.M.N.S. are held on charge by the N.C.Os. or orderlies concerned. S.O. R.A.M.C. 1937, paras. 171 and 238.

In addition to these there are also held on charge items purchased either under the official shilling-a-bed fund or from private funds. The shilling-a-bed fund is authorized by Allowance Regulations. For example in a military hospital of 100 equipped beds £5 is allowed to be spent each financial year on articles which are likely to give greater comfort to the sick, but which are not authorized by schedules (hospital). The bills are submitted to Headquarters for approval, and payment is made by the Command Paymaster. Allie. Regns. 1938, paras 711-717.

It can be readily appreciated that to keep the equipment straight frequent inspections are necessary, particularly in the military hospital where there are items on charge under four headings, namely :—

- (1) The normal barrack equipment for the ward or department.
- (2) Linen and bedding.
- (3) Other articles on permanent or temporary loan from the linen store.
- (4) Articles purchased from the shilling-a-bed and other funds.

A further duty of the Quartermaster in connexion with barrack equipment is to arrange for its exchange when it becomes unserviceable or requires repair. This includes the changing of burnt-out electric bulbs. These exchanges are usually made once a month, and Army Form F.765 is used for the transaction. Articles of barrack equipment for exchange are not accepted into barrack store unless they are in a clean condition. Regns. S.T. & B.S. 1930, para. 691.

Electric lamps can be exchanged provided only the filament is burnt out. If they are broken in any way then the matter becomes one to be dealt with according to circumstances, that is on Army Form I. 1229 if an accidental breakage, or on Army Book 51 if chargeable against an individual. Regns. S.T. & B.S. 1930, para. 683 (a).

Whilst on the subject of barrack equipment it would be well to mention the most important function of the linen store, and that is the procedure for the exchange of soiled linen, clothing, etc., for clean articles. Ordinarily this is done at the barrack stores once a week, and Army Book 200 is used for the purpose.

The procedure briefly is this :—

Army Book 200 is prepared by the sister or orderly in charge of the ward, giving details of the numbers of clean articles of linen, bedding, and clothing required in exchange for soiled items. This is taken to the linen storekeeper who issues the clean articles and retains the copy of A.B.200 until the equivalent number of soiled articles has been received. The soiled linen from the wards and departments is collected in the foul linen store and is exchanged once a week with the Expense Store Accountant. S.O. R.A.M.C. 1937, para. 214.

The linen storekeeper in carrying out these exchanges has to keep a

sharp look-out for any articles which are, for example, not of Army pattern, badly stained, or which in any way appear to have been used for an improper purpose. For instance it is sometimes found that medicine cloths have been used for washing the floors, and dusters for cleaning brass work. This sort of thing raises complaints from the laundry people, who cannot get the articles clean, and causes considerable difficulty with the barrack department who, quite rightly, raise objections to exchanging them, as articles are, after all, supposed to be used only for the purpose for which they are issued.

S.O. R.A.M.C. 1937, para. 216. It is also the duty of the linen storekeeper to see that the articles received back from the Expense Store Accountant are in a serviceable condition, have been properly washed, and are correct in number and description. The transaction between the linen storekeeper and the Expense Store Accountant is also carried out on Army Book 200. These weekly exchanges between the hospital and the Expense Store Accountant are entered into Army Book 175, which is the hospital bedding and clothing account and washing book.

S.O. R.A.M.C. 1937, para. 214. According to regulations the washing book should be totalled up once a month and the numbers of each article of linen and bedding entered on Army Form F.702 and each article of clothing on Army Form F.762. (In some Commands it is done once a week.) These forms, which actually show all washing transactions throughout the month or week as the case may be, are signed by the O.C. and transmitted to the Officer i/c Barracks.

All articles of clothing, bedding and linen used in venereal disease wards are kept quite distinct both in the linen store and on the washing lists, and the articles have to be disinfected before they are handed over to the Expense Store Accountant for washing. A certificate to that effect is entered on both Army Forms F.702 and F.762.

S.O. R.A.M.C. 1937, para. 220. The stocktaking of the linen store is carried out once a month and a stock-taking report (Army Form I.1227) is made out.

This form is completed so as to account for every article held on charge, and the top line of each sheet gives the number of articles under the various headings according to the inventory. Then underneath are shown, for example, articles in the foul linen store, at the disinfectant, those covered by accidental breakage certificates, personal charge, articles due from barrack store, those on permanent or temporary loan to wards and departments, on charge to the matron in the bedding book, and in possession of patients in hospital. The total of these items under the various headings when deducted from the number held on charge, represents what should actually be in store on the day of stocktaking. Every item in the linen store is then counted and the result entered on the stocktaking report.

This is a fairly long and tedious job.

#### *(b) Medical Equipment.*

The scales of medical equipment allowed for the various medical units and special departments of a military hospital are laid down in Appendices 25 to 37 of the Regulations for the Medical Services of the Army, 1938.

In military hospitals of over forty beds this equipment is accounted for in loose-leaf ledgers, Army Forms I.1211 for drugs, and Army Form I.1212 for other medical equipment. Regns. M.S.A.  
1938, para. 452.

In the case of military hospitals of forty beds and under and other small medical units, a small bound ledger, Army Book 40, is used.

In military hospitals of over forty beds the consumable articles such as drugs and dressings held in the reserve store and all non-consumable articles in possession of the unit are held on ledger charge, but directly consumable articles are issued from the reserve store to the dispensary they are struck off ledger charge. Such issues are supported by dispensary indents on Army Book 30, which form the supporting issue vouchers for the ledger. Regns. M.S.A.  
1938, para. 454  
(a).

In the case of smaller units the procedure is slightly different ; the whole of the medical equipment, including that in the dispensary, is held on ledger charge until the end of the year, when that remaining on charge is deducted from the total receipts, the difference between the two being shown as the expenditure. Regns. M.S.A.  
1938, para. 454  
(b).

Medical equipment ledgers are balanced annually on March 31, and forwarded within thirty days with all supporting vouchers to the Army Auditor in whose office the accounts are very thoroughly checked and whose observations, if any, are received in due course. In Commands where no Army Auditor is appointed the accounts are sent to the Under Secretary of State (F.7), the War Office. Regns. M.S.A.  
1938, para. 455.

The medical equipment accounts of military hospitals in charge of a C.M.P. are rendered for audit through a Quartermaster nominated by the D.D.M.S. of the Command. The Quartermaster has to sign the examination of the account certificate on A.F. I.1210 and on A.B.40 and is responsible for securing any necessary explanations or adjustments that may subsequently arise thereon. Regns. M.S.A.  
1938, para. 455  
(b).

Also at the end of the year a balance sheet of medical equipment is prepared (A.F. I.1200). On this form is shown the whole of the medical equipment remaining on ledger charge as on March 31. It also gives the expenditure of consumable items which has taken place during the year. Regns. M.S.A.  
1938, para. 456.

From these returns the D.D.M.S., the Army Auditor, and the War Office are able, to an extent, to judge whether stocks of drugs are being held in excess of requirements.

So much for the accounting for medical equipment ; the next item is the maintenance of stocks.

Indents to replenish stocks are prepared half-yearly on Army Form I.1209 and submitted to the War Office through the D.D.M.S. of the Command. Normally only such items as are authorized by regulations should be asked for, but where unauthorized drugs or appliances are required and included in the indents, a full explanation of the circumstances which render them necessary has to accompany the demand. Regns. M.S.A.  
1938, para. 393.

Indents for each half-year should normally be based on the expenditure during the corresponding half of the previous year. For example, if indents

are being prepared for the period October 1, 1934, to March 31, 1935, the demand would normally be based on what was actually expended during the period October 1, 1933, to March 31, 1934.

Regns. M.S.A.  
1938, paras. 392  
and 398.

The purpose of the regulations is to avoid excessive demands and at the same time to prevent the necessity for intermediate indents and this is not altogether an easy matter.

One of the reasons which makes it difficult to avoid intermediate demands is a sudden run on certain drugs which could not have been foreseen when the half-yearly demand was prepared. This is generally due to changes or new ideas in the method of treatment and often coincides with the arrival of new medical officers.

Regns. M.S.A.  
1938, para. 398.

In such cases, of course, supplementary indents cannot be avoided and these have to be accompanied by an explanation giving the reasons which makes them necessary.

Regns. M.S.A.  
1938, para. 404.

In cases of urgency drugs can, however, be purchased locally, but the covering approval of the D.D.M.S. has to be applied for at once. The D.D.M.S. can, of course, refuse to give covering approval in cases where he considers sufficient urgency did not exist to warrant local purchase. The trouble with local purchases, particularly at some stations overseas, is that a much higher price has to be paid, compared with the cost if the articles were obtained from Army sources.

Bills for articles purchased locally are, after approval, passed to the Command Paymaster for payment and the drugs are taken on charge in the ledger.

The replacement of medical stores becomes necessary for various reasons : for example :—

(1) The expenditure of consumable articles such as drugs, dressings X-ray films.

(2) The replacement of glass articles which are broken by accident or otherwise.

(3) The replacement of non-consumable stores which have become unserviceable through fair wear and tear, have become lost or damaged beyond repair.

The expenditure of consumable stores is, of course, supported by issue to the dispensary on Army Book 30.

Regns. M.S.A.  
1938, para. 419.

The replacement of broken glass articles is either covered by Army Form I.1229 (Accidental Breakage Certificate), or by personal charges. Clinical thermometers, if written off as a charge against the public, have to be supported by Army Form I.1230, signed by the D.D.M.S.

Regns. M.S.A.  
1938, para. 423.

As regards non-consumable stores which become unserviceable through fair wear and tear, these are usually collected into store and are brought before a Board of Survey which assembles once a year in October. This Board decides which articles are good enough to be sent for repair and which should be destroyed as no longer serviceable. The proceedings of this Board after approval by the D.D.M.S. form the voucher in support of the articles shown as destroyed and written off charge.

As regards losses or damages to non-consumable stores other than glass articles, these are dealt with in accordance with King's Regulations. If the charge is against an officer or nursing sister, Army Form O.1680 (Paymasters Debit Voucher) is used ; if against a soldier on the hospital staff the amount is paid through the soldier's account and Army Form P.1963 (list of men placed under stoppages) is used ; the write-off in the ledger being supported by Army Form P.1925 (Expense Store Voucher—General Service). In the case of patients Army Book 51 (Personal Charge Book) is used. Regns. M.S.A. 1938, paras. 152 and 416.

In cases where there is doubt as to whether the loss or damage should be borne by an individual, Army Form I.1230 (Report of Deficient or Damaged Medical Equipment) is completed and submitted to the D.D.M.S. for decision. Regns. M.S.A. 1938, para. 416.

In addition to indents to replace items expended, lost, broken, or worn out, items requiring repair have to be dealt with. Indents for repairs should be included as far as possible in the half-yearly demands ; if, however, the article or articles are urgently required, an indent is submitted at once. Regns. M.S.A. 1938, para. 420.

Minor repairs such as grinding, polishing and setting of knives, saws and scissors, hard and soft soldering, repairs to splints and small sterilizers, can usually be carried out at the Army Medical Store, Woolwich, but such items as replating and renewals of parts, repairs to articles made of rubber, vulcanite, or glass, and repairs to the various surgical instruments are carried out by contractors at home. In all cases where instruments, etc., are sent to contractors for repair, receipts for the articles should invariably be obtained. Regns. M.S.A. 1938, paras. 421 and 422.

Repairs to medical panniers and similar articles may be carried out locally in R.A.O.C. workshops or, as an alternative, if this work cannot be done there, the D.D.M.S. can authorize such slight and inexpensive repairs to be carried out by local tradesmen at the public expense. Regns. M.S.A. 1938, para. 424.

Similarly minor repairs to electro-therapeutic equipment may be referred to the C.R.E. for local repair. Regns. M.S.A. 1938, para. 425.

What has been said so far deals generally with normal equipment in use during peace. In addition to this, field medical equipment is stored in readiness at certain stations at home during peace for issue to units, medical and others, directly mobilization is ordered.

This equipment has frequently to be inspected and overhauled and a turnover made of the perishable articles to ensure that the equipment when required is in a serviceable condition. At some stations at home, where stores for the large field medical units, such as general hospitals, are held, a special staff is allowed, as the turnover and care of this equipment involves a tremendous amount of work. Regns. M.S.A. 1938, paras. 444-451.

This mobilization medical equipment is inspected on January 1 and July 1 each year by a Board of medical officers, and the Board should be composed as far as possible of those detailed for duty with the unit on mobilization. When dental equipment forms part of the mobilization equipment, a dental officer should be included as a member of the Board. Regns. M.S.A. 1938, para. 451.



Medical mobilization equipment has to be kept ready for issue at any time and reserves exclusively for the Unit to which it is allotted.

Regns. M.S.A.  
1938, para. 447.

At home, no portion of it may be used in peace without special War Office authority obtained through the usual channels.

At stations *abroad*, such equipment may be used in emergencies at the discretion of the G.O.C.-in-C.

On no account is medical mobilization equipment allowed to be used on manœuvres.

(c) *Ordnance Equipment.*

In peace-time, few transactions are carried out direct with the R.A.O.C., and these are mostly by the Company and concern such items as clothing and necessaries, tentage, instructional equipment for camps, public clothing, and the personal equipment of the troops.

Equip. Regns.  
Pt. 1, 1932, para.  
405.

Indents for equipment required to complete to scale or to replace unserviceable articles are submitted monthly to the D.A.D.O.S. on Army Form G. 997. This form is also used to indent for materials for the repair of respirators.

For camp equipment Army Form G. 968 is used, and for small arm ammunition Army Form G. 812. As regards camp equipment, if the quantities required are small, Army Form G. 997 may be used instead of the G. 968.

Equip. Regns.  
Pt. 1, 1932, para.  
405.

In addition to indenting for ordnance stores, it is sometimes necessary to return them for repair, and in such cases a workshop indent, Army Form G. 1045, is submitted to the D.A.D.O.S., who arranges for the articles to be repaired at R.A.O.C. workshops.

Equip. Regns.  
Pt. 1, 1932, App.  
I, para. 1.

All equipment on charge to a unit is accounted for in the Equipment Ledger (Army Book 253). The ledgers will remain open and in use until called for by the Army Auditor or the War Office, for audit. When so called for, they will be balanced and the balances carried into new ledgers.

Appendix 1,  
Equip. Regns.  
1932, Pt. 1.

There is a special Appendix in the Equipment Regulations which gives full instructions for the keeping of equipment ledgers.

Equip. Regns.  
Pt. 1, 1932, para.  
145, et seq.

Whilst on the subject of equipment it might be mentioned that R.A.M.C. and A.D. Corps personnel below the rank of Warrant Officer, Class I, do not take with them their personal equipment when moving from one station to another at home. They only take their anti-gas respirators. When, however, they proceed from home to stations abroad, or vice versa, they take their respirator, haversack, water-bottle, braces with buckle, and mess tin, but leave behind their white walking-out belt, their web equipment belt, pack with supporting straps, and attachments brace.

Equip. Regns.  
Pt. 1, 1932, para.  
327.

Officers, R.A.M.C. and The Army Dental Corps, and members of the Q.A.I.M.N.S. also take with them their respirators when moving from one station to another, except to India.

Equip. Regns.  
Pt. 1, 1932, para.  
279.

Whilst on the subject of equipment, it might be of interest to mention that an officer on first appointment to the R.A.M.C. and The A.D. Corps receives a free initial issue of camp kit including a camp bedstead, pillow,

groundsheet, washstand, basin, bath, bucket and chair, also three new brown blankets. This kit is maintained at the expense of the owners. Regns. for S.T. & B.S., 1930, para. 761.

Members of the Q.A.I.M.N.S. also get a free issue of this camp kit when first ordered on active service.

In addition to this, officers of the R.A.M.C. and The A.D. Corps who are granted permanent commissions get a free issue of a pair of binoculars and a prismatic compass. These two items remain his personal property, provided the officer serves four years, otherwise, unless there are some special reasons, they must be returned to store in a serviceable condition, or be paid for. Equip. Regns. Pt. 1, 1932, para. 35.

As regards clothing and necessities, units are supposed to maintain a sufficient stock to meet requirements for three months. Clo. Regns. 1936, para. 6.

An N.C.O. or storekeeper and sometimes both (depending upon the size of the Company) are required to carry out the work of the store, which consists in keeping stocks clean and free from such pests as moths, silverfish or "woolly bear," preparing indents to meet requirements and keeping the transactions posted to date in the clothing ledger.

Indents on Army Form H. 1181 for personal clothing and necessities on payment, and on Army Form H. 1179A for free issues, are prepared monthly by the Company Officer, and issues to the Company are made by the Quartermaster. Clo. Regns. 1936, paras. 19, 358, and App. 1.

The prices of the articles issued on payment are entered on Army Form H. 1181, and the individual concerned signs for them at the foot of the form and inserts date received. This form, together with A.F.H. 1181A, showing total number of each article sold, their value, and the total amount to be recovered from the company, is forwarded as early as possible and not later than one week before end of the account period, to the Regimental Paymaster for pre-audit. The Regimental Paymaster return A.F.H. 1181 to the Company Commander who charges the amounts against the individuals in the pay and mess rolls, and credits the total to the public in the company account. Clo. Regns. 1938, App. 1, para. 2.

The R.P. retains A.F.H. 1181A as a voucher to the company account.

Indents for clothing and necessities are prepared on Army Form G. 997 and are submitted to the D.A.D.O.S. of the area. Clo. Regns. 1936, para. 347.

All transactions are accounted for in the clothing ledger, Army Book 285. This ledger is closed and balanced at the same time as the equipment ledger. When the ledger is closed a stocktaking board is assembled to count the articles actually remaining in store and the proceedings of the board are recorded on Army Form H. 1164 which accompanies the clothing ledger when forwarded for audit. Clo. Regns. 1936, App. 2, paras. 26 and 28.

*Mobilization Clothing and Equipment.*—Under the heading of Ordnance Equipment a few words might be said in regard to the system of the storage in peace of clothing and equipment required to clothe and equip reservists who report for duty at the various R.A.M.C. companies at home on mobilization.

The arrangement generally is that these reservists, under instructions

from the Officer i/c Records, join for duty on mobilization at the depot and headquarters of the various R.A.M.C. companies at home, and as it is necessary that these reservists should be clothed and equipped immediately on joining, steps have to be taken in peace to store sufficient equipment, clothing, and necessaries to enable this to be carried out.

Briefly what happens is this :—

Mob. Regns.  
1932, para. 44.

The Officer i/c Records keeps O.s.C. R.A.M.C. companies informed as to the reservists who will join the company on mobilization and their distribution to units.

Mob. Regns.  
1932, para. 80.

The O.C. the R.A.M.C. Company is responsible for completing an Army Form G. 1091 for each reservist due to join his company. This form shows in detail the equipment and clothing which have to be issued to the man on mobilization. When the reservist joins on mobilization this Army Form is handed to him and the articles shown thereon are issued from store, and the reservist signs the form in acknowledgment of their receipt.

Clo. Regns.  
1936, App. 14,  
para. 4.

In the days prior to the Great War, the complete kit of each reservist was kept separate and ready for issue when required, by means of a system of racks which were provided for the purpose.

Clo. Regns.  
1936, App. 14,  
paras. 9 and 10.

Nowadays the whole of the clothing and necessaries are held in bulk in the original cases and bales as received from the R.A.O.C. The description, size and number of articles, also the date of packing, are marked on the end of cases and bales, and these are arranged in the store so that the markings can be easily read.

Clo. Regns.  
1936, paras. 6  
and 11 of App.  
14.

A record of the dates marked on bales, packages, etc., held for reservists is kept in S.O. Book 136. In the case of articles which require fitting, Units are allowed to hold 10 per cent. spares.

Clothing and boots of abnormal sizes are not stored in peace.

Clo. Regns.  
1936, App. 15,  
para. 4.

Any "special size" articles required will normally be issued from the Unit's three months' peace stock or by exchange with neighbouring Units, or by indent from the Clothing Depot supplying the area. In the case of special size boots, these may, where necessary, be purchased locally, provided the cost does not exceed military rates.

Clo. Regns.  
1936, App. 14,  
paras. 14 and 15.

A Turnover Book (Army Book 333) is kept by officers who hold mobilization equipment and reservists' kits on charge. Into this book are entered any items which the officer holding the equipment has reason to think may have deteriorated and considers should be specially turned over, irrespective of date of packing or manufacture (normally a turnover is made of articles which have been stored for five years or more), also any articles which may have been superseded by a later pattern.

Clo. Regns.  
1936, App. 15,  
paras. 17(a), (b)  
and (c).

There is a good deal of work in the care and preservation of reservists kits; such articles as boots, knives, forks, razors and mess tins require periodical inspection. Knives and forks should be inspected frequently and wiped with an oily rag at least once every twelve months.

Instructions for the general care and preservation of clothing are laid down in Clo. Regns. 1936, App. 11.

Arrangements should be made to exchange articles found to be defective at periodical examinations.

Clothing and necessities held for reservists are inspected once a year by the D.A.D.O.S. Clo. R e g n s.  
1936, App. 14,  
para. 19.

The clothing and necessities are not marked until after issue to reservists.

Mobilization clothing and necessities are normally accounted for in a ledger, Army Book 284A, and this is balanced and rendered for audit once a year at the same time as the ordinary peace clothing ledger. Clo. R e g n s.  
1936, App. 2,  
para. 32.

Having dealt with duties in connexion with the charge of buildings, R.E. fixtures, and the various stores and equipment, this might, before going on to the next heading, be a suitable moment to say a few words on the general procedure which has to be carried out when a change takes place in the command of a Military Hospital and Company, R.A.M.C.

*Buildings and R.E. Fixtures.*—Arrangements are made with the Garrison Engineer for a representative from his department to carry out, with the Quartermaster, a complete inspection of the buildings and R.E. fixtures on charge. (This inspection does not usually include married quarters which are occupied, as the occupants are responsible for meeting any deficiencies or damages noted on vacation.)

*Barrack and Hospital Equipment.*—Similar arrangements are made with the Officer i/c Barracks for a representative from his department to carry out a complete check of the barrack and hospital equipment on charge to wards and departments of the military hospital, and also in the barrack rooms and outhouses, messes, etc., but not occupied married quarters.

*Medical Equipment.*—It is not necessary for the officer taking over to check every item of medical equipment. He should, however, at once take steps to test the accuracy of the stock of such stores by comparing certain items with the ledger balance.

There seems no object in a new commanding officer wasting much of his valuable time during the period of taking over by checking common and inexpensive drugs, but it is well to check dangerous and costly drugs and the more valuable and important instruments and items of equipment.

A certificate has to be furnished to the effect that he has tested the accuracy of stocks and has no reason to doubt the general agreement of the stock with the balance as shown in the ledger. This certificate has to be forwarded to the local auditor.

*Clothing.*—Normally a regimental board is assembled to take stock of the clothing and necessities and verify the ledger balance; however, if the officer taking over charge considers it unnecessary, the board may be dispensed with, but he is held responsible for the correctness of the clothing taken over and must sign the necessary certificate which accompanies and supports the ledger when sent for audit.

*Equipment.*—The procedure is the same as for clothing.

(To be continued.)

## Editorials.

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### THE TREATMENT OF ANAEROBIC INFECTIONS WITH SULPHAPYRIDINE AND WITH IMMUNE SERA AND THE PROBLEM OF SYNERGIC ACTION.

THE dramatic success of the sulphonamide series of drugs in the treatment of certain infections caused by aerobic organisms and their use as substitutes for serum therapy has tended to obscure the potential advantages that might accrue from combined treatment with drug and immune serum. W. W. Henderson and P. A. J. Gorer have been interested in the theoretical and practical aspects of the problem of combined action in so far as it might be concerned in the prophylaxis and therapy of infection caused by certain spore-bearing anaerobes. They were encouraged to pursue the problem as experiments seemed to indicate that sulphanilamide and its related compounds are of value in the treatment of gas gangrene, and the advent of the war gave the subject a practical importance.

They consider that the genesis of infection with a spore-bearing organism is determined by the physico-chemical conditions governing germination of the spores. Once germination of the spores has taken place the course of the disease is determined not only by the products of bacterial metabolism but also by the capacity of the vegetating organism to invade the healthy tissues of the host. The species included in the gas-gangrene group of spore-bearing anaerobes vary greatly in this respect. Those of low invasive capacity remain relatively localized near the original site of tissue damage, although the necrotizing toxin extends the area for their proliferation. The truly invasive species such as *V. septique* and *Cl. chauvæi*, and possibly certain strains of *Cl. welchii* are not confined within the extending area of necrosis and may advance into apparently healthy tissue. There are three lines of approach to prophylaxis or therapy: (1) Control of bacterial infection; (2) neutralization of accumulated toxin; or (3) a combination of both. The control of infection by neutralization of accumulating toxin is to be regarded as a secondary line of defence; it enables the body to mobilize antibacterial and repair mechanisms that will deal effectively with a traumatic lesion supporting bacterial proliferation. Antitoxic measures for the control of infection with species of high invasive capacity are problematical in effectiveness; the final issue depends on the ability of the host to muster an antibacterial defence and this is greatly influenced by the route of infection. A most interesting result of experiments is the difference between the combined action of sulphapyridine plus antitoxin, and that of antibacterial plus antitoxin serum. The slight but direct bacteriostatic

action of the sulphapyridine and the neutralizing action of the antitoxin gives time for the natural defence system to be mustered, and it is this third factor in the presence of the other two agents which brings about the striking result.

In the *Journal of Hygiene* for May, 1940, W. W. Henderson and P. A. J. Gorer record their experiments on the treatment of gas gangrene anaerobic bacteria with sulphapyridine alone or in conjunction with antitoxin or antibacterial serum. These workers used *Cl. septicus*, the infecting dose of which could be controlled, and the intradermal and intramuscular routes. They found that the drug alone was fairly effective in controlling intradermal infection, but when given prophylactically and in continuous dosage it could only save half the mice infected intramuscularly. Sulphapyridine had a slight action on intradermal infection of *V. welchii*, but none at all on intramuscular infection of this organism. It had no neutralizing effect on the toxins of either *Cl. welchii* or *V. septicus*. On the other hand, antitoxin was very successful in saving mice even when given six hours after intramuscular infection of *Cl. welchii*. Intradermal infection with *V. septicus* was used to test the possible synergic effect between drug and antitoxin and antibacterial serum, and the experiments were so planned that any of these agents would only protect 5 to 10 per cent of the infected animals. It was found that sulphapyridine plus antitoxin produced a survival rate of 88 per cent compared with only 7 to 8 per cent in the controls. The drug plus antibacterial serum produced 72 per cent of survivals. A combination of antibacterial and antitoxic sera saved only 15.5 per cent of infected animals. In *Cl. welchii* infection the combined action of antitoxin and sulphapyridine produces a notable synergic effect, but the evidence on this point is less clearly defined.

In intradermal infection with *V. septicus* the combined action of sulphapyridine and antitoxin or of sulphapyridine and antibacterial serum effects a saving of life much greater than would be expected if a mere summation effect is in question. A similar effect is observed in intramuscular infection provided the administration of the drug is sufficiently prolonged. No such synergic effect is produced by the combined action of antitoxic and antibacterial serum.

A very important observation was that one dose of antitoxin combined with continued administration of sulphapyridine raised the survival rate of mice infected intramuscularly with *Cl. septicus* from 0.20 to 70 per cent.

Henderson and Gorer point out that their results were obtained with single strains of *Cl. welchii* and *V. septicus*, and that there is considerable difference between the toxigenicity and invasiveness of different strains, particularly of *Cl. welchii*. There appears to be no doubt that considerable synergic action exists between the drug and antitoxin; the antitoxin probably neutralizes the bacterial toxin, while the drug exerts a bacteriostatic action on the organism itself.

In view of these results it has been suggested that every wounded patient in whom gas gangrene is diagnosed or suspected should receive an adequate

dose of polyvalent antitoxin. It should be given intravenously at the earliest possible moment, one therapeutic dose for the suspected case and for the established case three to five doses combined with 6 to 9 grammes of sulphapyridine daily until the infection is controlled.

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### ACTION OF ANTISEPTICS ON WOUNDS.

L. P. GARROD, in the *Lancet* of May 4, 1940, draws attention to the selective action of antiseptics which differs with bacterial species. Spore-forming bacilli and tubercle bacilli are exceptionally resistant owing to their impenetrability. *Ps. pyocyanea* and *Streptococcus faecalis* are also very resistant for no obvious reason. The antiseptic may exhibit unequal degrees of activity peculiar to itself against different types of micro-organisms. These extreme inequalities are only seen in antiseptics such as dyes, which act in high dilutions; their effect on certain bacteria is due to a peculiar affinity. Phenol, on the other hand, is a protoplasmic poison and acts equally on most types of non-spore-forming micro-organisms.

Staphylococci are intensely susceptible to the violet dyes; streptococci are a little less so; most Gram-negative bacteria are highly resistant to these dyes. The acridine compounds, on the other hand, exert their most powerful action on hæmolytic streptococci, staphylococci being less susceptible. The pneumococcus is peculiarly susceptible to optochin. *Ps. pyocyanea*, which flourishes in the presence of many antiseptics, readily succumbs to dilutions of acetic acid which other bacteria can resist.

This selective action can only be taken into practical account in an established infection in which the responsible organism has been identified. Garrod thinks that in this sphere of therapeutics effective treatment is much less feasible than prevention.

If an antiseptic is not wholly lethal, certain resistant organisms begin to multiply. Therefore, it is advisable to discontinue an antiseptic if it does not achieve its effects after several days.

The form in which an antiseptic is applied is important; solutions of phenol in water are highly toxic, but a 5 per cent solution of phenol in olive oil is bland and unirritating but inert. To dissolve or emulsify an antiseptic in oil usually prevents its diffusion into a watery medium and destroys its effect. The acriflavine emulsion of the B.P.C. is another example; this is inert.

The incorporation in a semi-solid oily basis in the form of bipp deprives iodoform of its power to restrain bacterial growth. Most ointments are ineffective, but if made up with vanishing cream they act better. The proper vehicle for an antiseptic to be applied to a wound is water, and the solution should, if possible, be rendered isotonic.

If the possibility of prophylactic treatment of wounds is considered impartially Garrod thinks it must be admitted that prophylaxis is a very

different thing from the treatment of an established infection of a wound and should be easier to achieve. The number of bacteria is comparatively small and they are in a wound cavity more or less accessible to treatment from without. From observations on experimental wounds and by analogy with the lag period in cultures, it can safely be concluded that the proliferation of the bacteria and invasion of the tissues will not occur for two hours or more. During this period an antiseptic will have an easier task than on the following day, when the tissues are involved and no known antiseptic is capable of reaching the now enormous numbers of invading bacteria. The prevention of infection does not necessarily require that all the bacteria contaminating a wound must be destroyed. It has been demonstrated by experiment that there is a minimal infecting dose varying with the virulence of the bacteria at the time and the resistance of the host; a number less than this can be dealt with by the body. Exposure to no more than sub-lethal concentrations of antiseptics for only a few minutes greatly reduces bacterial virulence; this effect is known to be produced by acriflavine on streptococci.

Garrod considers there are two policies, either of which might be adopted for the prophylactic treatment of wounds. First, the effect on the tissues in the wound may be disregarded for the sake of securing complete disinfection. An instance of this was the application of pure phenol as in the early days of the Great War. Methods so drastic have the drawback of leaving necrotic tissue liable to further infection. There is more to be said in favour of using antiseptics not so grossly toxic but rapid and powerful in their action on bacteria; among these the less toxic coal-tar derivatives, such as cyllin, izal, and dettol, deserve consideration. Used in adequate strength they kill bacteria in a few minutes even in mixtures containing blood, and they cause no gross damage to the tissues. They may kill such leucocytes as were in the wound. These are few and easily replaced, and it is clear from clinical experience that there is no really disastrous effect on the cells of skin, connective tissue, or muscle. No other class of antiseptic combines rapidity of effect with adequate activity in the presence of blood. Dyes and acridine compounds act in blood but slowly; the halogens act quickly but not in blood. In the category which accepts microscopic cell damage for the sake of more efficient disinfection must be placed the use of such dyes as crystal violet and brilliant green.

The alternative policy is to insist that adequate disinfection shall be combined with minimum toxicity to the tissues so that no damage may be done to specialized cells. There is no answer to this demand except in the acridine compounds. Experiments have shown that these compounds have been able to prevent infection when experimental wounds in animals are inoculated with virulent bacteria, and that prolonged action is necessary to secure adequate disinfection is the main drawback of these substances which in the ideal treatment should remain in the wound cavity for an hour or more. To apply a dressing or to pack with gauze soaked in the antiseptic



is not ideal because the affinity of the cotton for dyes leads to the retention of the antiseptic in the substance of the dressing. Solutions of acridine compounds can be injected interstitially without ill-effect, and thorough infiltration of the tissues round a small but dangerously infected wound is good treatment. It is particularly indicated for punctured wounds sustained accidentally during septic operations, the track of which is narrow, inaccessible to external appliances, and perhaps untraceable.

Where an antiseptic cannot reach it cannot act, and excision is the only measure which will deal effectively with such a condition. Where excision has to be delayed antiseptic treatment should be used for what it is worth.

The effect of antiseptics applied to infected wounds depends on two factors: The depth from the surface which the bacteria have reached, and the depth to which the antiseptic can follow them—penetration of tissue. Studies of the penetration of tissues by antiseptics are few and incomplete, but such as there have been seem to show that a fraction of a millimetre is the limit for most of them, so it is foolish to expect any effect on spreading cellulitis, on suppuration spreading on fascial planes or between muscle bundles, or on gas gangrene. The control of actively spreading infection is the sphere of systemic chemotherapy with sulphonamide compounds.

If no active spread is taking place in a wound but healing is delayed, the surface may be formed by superficial sloughs or by granulation tissue exuding pus. Antiseptics applied to such wounds prevent the access of further infection, deodorize the wound, and mechanically cleanse it. The process of mechanical cleansing is well served by solutions containing chlorine or liberating oxygen, both of which tend to disintegrate necrotic material. The shedding of sloughs may be accelerated by stimulating the exudation of fluid and the good results claimed for certain antiseptics may be due to it. More profuse fluid exudation can be obtained by applying hypertonic saline solutions; sulphate of soda is said to be the most active. Garrod considers that the depth to which infection extends in different types of non-spreading infection of wounds is imperfectly understood and well worthy of study. Our incomplete knowledge on this point and of the capacity of various antiseptics for different types of tissue makes it difficult to decide whether any substantial part of the effect is due to influence on the bacteria beneath the surface of the skin of the wound. He believes it is much more likely that in granulating and suppurating wounds the observed effects—e.g. the disappearance of *Ps. pyocyanea* after the application of acetic acid—are due to the destruction of bacteria which are simply multiplying in the discharge from the wound and are not in the tissues at all.

A serous or purulent exudate which collects in a cavity forms an admirable culture medium for some types of bacteria, and it is doubtless useful to get rid of them, but this does not imply the sterilization of tissue. Whatever antiseptic treatment is adopted it should be strictly limited in duration. The killing of bacteria is final, and if it is not accomplished within a day or two there is no reason why it ever should be, and one good reason

why it should not : the fact that exposure to sublethal concentrations of antiseptics produces in bacteria an increased resistance to them. Long-continued application is also contra-indicated because of its effect on the growth of reparative tissue. Clinical experience suggests that continuous irrigation with a weak hypochlorite solution by the Carrel-Dakin method may with advantage be continued rather longer than the application of other kinds of antiseptic, especially in dealing with large and dirty wounds. It is also reasonable if one antiseptic fails to try another for an adequate but limited period. Garrod writes that to take this somewhat sceptical view of the antiseptic treatment of infection in wounds is not to deny that such treatment can be highly effective in other situations. The response of thrush to the application of violet dyes is almost miraculous, presumably because the infection is more superficial and therefore more accessible ; some superficial skin conditions are also amenable to such treatment. The depth to which the infection extends must be considered the paramount factor in determining whether surface applications can control it. He considers that the undeserved contempt for antiseptics which is now so common is largely based on beliefs which arose during the Great War when the almost universal judgment on experience with casualties in France was that antiseptics had failed. There are particular reasons for this failure which forbid the application of this judgment to the treatment of wounds as a whole. Perhaps the chief of these was that treatment was so often necessarily delayed. It cannot be too strongly emphasized that the prevention of infection in wounds is entirely different from its treatment when infection has become established, and prevention in this sense is only possible for an hour or two after the infliction of the wound. Invasion of the tissues then begins and disinfection of the wound cavity is of no avail. Much of the use of antiseptics in France was not prophylactic, but the treatment of a developing infection which could not often succeed. Another cause of failure is to be found in the characteristics of the gunshot wound ; it consists of a long narrow track through muscle or viscera at the end of which may be a foreign body, a shell fragment, and a dirty piece of clothing. The deeper parts of such a wound are inaccessible. These two factors will always counteract the success of antiseptics in military surgery and were mainly responsible for the failure of such treatment in France. If anything more were needed to explain it some of the methods used furnish the answer. Strong phenol, strong cresol pastes, and formalin were freely used in the early part of the war, and it was not until the introduction of Dakin's solution and of the flavines that any method came into general use which was at all likely to do more good than harm.

It must be remembered that military casualties coming to this country now may have received prophylactic doses of sulphanilamide or of sulphapyridine, and it is hoped that septic wounds will be materially less in this war than in the last.

Garrod draws attention to the fact that there is no generally accepted

method of testing the disinfecting power of an antiseptic to be used in wounds or of assessing the degree of damage it will do to exposed tissues. The general adoption of such methods and the acquisition through them of comparable data for all antiseptics in common use would clarify what is now a confused position. Distinct from immediate damage is the effect of prolonged application on the ratio of healing ; this is readily susceptible to experimental study.

The method of the prophylactic treatment of wounds in the experimental animal which has so far awarded all the prizes to the acridine compounds, needs to be more widely applied ; the position of other dyes, of the organic mercury compounds, and of emulsified antiseptics derived from coal-tar would be clearer if data obtained by this method were available for them.

Finally, any study of disinfectant action, whether *in vitro* or *in vivo*, can be usefully amplified by embracing bacteria other than the pyogenic cocci.

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## Clinical and other Notes.

### TWO CASES OF UNDULANT FEVER TREATED WITH SULPHANILAMIDE.

BY CAPTAIN R. J. G. MORRISON,  
*Royal Army Medical Corps.*

THE following is a brief account of two cases of undulant fever which were successfully treated with sulphanilamide.

Both patients were Indian cooks of No. 2 Company, Indian Hospital Corps, and were employed in the kitchen of the British Military Hospital, Lucknow. The source of infection was probably identical in the two cases and was considered to be due to drinking infected milk, as the serum agglutinations of the two cases were higher for *Br. abortus* than for *Br. melitensis*. A suspected sample of milk was examined for agglutinins with negative results, and the causative organism was not detected in blood cultures, but sterile cultures are the rule rather than the exception in undulant fever.

*Case 1.*—B. L., a Hindu, aged 27, was admitted to the Indian Military Hospital, Lucknow, on October 6, 1938. Apart from an attack of fever about four years ago the patient had previously been healthy.

About twelve days prior to admission a fever with rigors occurred which passed off after a few days. Three days before admission the fever and rigors recurred and a dry cough developed. There was also pain in the right elbow joint and in the fingers of the right hand. Slight sore throat was present.

On examination his temperature was 102° F. and pulse 100. The tongue was coated, slight pyorrhœa alveolaris was present and the pharynx was congested. The right elbow joint was not swollen, and the movements were free but painful. No other abnormal physical signs were detected—the urine was clear and contained no abnormal constituents. The white blood-count was 4,200 per cubic millimetre, with a normal distribution of cells.

A continuous fever occurred which disappeared after twenty-seven days. After thirty-six hours a relapse occurred and this was followed by a second afebrile period and a further relapse.

On November 8 treatment with sulphanilamide (p-amino-benzene-sulphonamide) was started. Instructions were given to administer 0·5 gramme four-hourly, but owing to a misunderstanding the night doses were omitted. The sulphanilamide was given for ten days. That evening the temperature was 101° F. On November 9 the temperature chart showed a rise to 100·4° F., but the next day the maximum temperature was only 99·6° F., and from thence onwards the patient was afebrile. He was discharged from hospital on December 5 after the temperature had been normal for twenty-five days.

The results of the agglutination reactions are shown in Table I.

TABLE I.

Date	T "O"	A "O"	T "VIB"	<i>B. proteus</i>			<i>Br. abortus</i>	<i>Br. melitensis</i>
				OXK	OX 2	OX 19		
9.10.38	300	20	—	25	0	25	—	—
15.10.38	175	0	—	37.5	0	0	—	—
20.10.38	0	0	0	0	0	25	—	—
27.10.38	17.5	0	17.5	0	0	37.5	1,500	750
3.11.38	—	—	—	—	—	—	1,000	350
28.11.38	—	—	—	—	—	—	500	300

*Case 2.*—A. G. K., a Mahomedan of 42 years, who had previously had no serious illness, was admitted to the Indian Military Hospital, Lucknow, on October 15 complaining of fever and general malaise which had been present for ten days. No rigors had occurred and no other symptoms were present.

On examination his temperature was 101.4° F. and pulse 94. He did not look ill and no abnormal physical signs were detected. The urine was normal on routine examination.

The white cell count was 8,400 cells per cubic millimetre and the differential count was normal.

A moderately high fever ensued which fell to normal by a gradual lysis on October 31.

A relapse occurred on the evening of November 1 and a pyrexial period of six days duration ensued. On November 8 another relapse started and sulphanilamide was administered. The drug was given in the same dosage and for the same period as in the first case. For the next three days a mild fever was present. Thereafter no fever occurred and the patient was discharged on December 17 after the temperature had been normal for thirty-seven days.

Table II shows the results of the serum agglutinations.

TABLE II.

Date	T "O"	A "O"	T "VIB"	<i>B. proteus</i>			<i>Br. abortus</i>	<i>Br. melitensis</i>
				OXK	OX 2	OX 19		
18.10.38	0	0	0	0	0	0	—	—
25.10.38	175	35	0	30	0	0	—	—
30.10.38	125	35	0	37.5	0	0	750	700
28.11.38	—	—	—	—	—	—	350	150

## DISCUSSION.

The severity of undulant fever is subject to a good deal of variation. Mild cases in which the fever lasts only for a few days are described, and there are other instances in which the febrile attacks persist for more than a year. The average duration of the disease is three months. This variability of the severity of the infections renders the assessment of the value of sulphanilamide treatment a matter of difficulty.

It is probable that in these cases sulphanilamide had a definite curative effect and the following facts are suggestive.

In Case 1 the duration of fever in hospital was thirty-six days and in Case 2 twenty-eight days. There is a difference of eleven days between the onset of symptoms in the two cases, and the sulphanilamide was started on the same date in each case. In both instances the drug was given during a pyrexial period and the temperature returned to normal on the same day and no further relapse occurred.

If, as appears likely in these cases, the response was directly due to sulphanilamide, then quite small doses may be effective. The accepted dosage of sulphanilamide for a patient with a fairly severe infection is 1 gramme for every 20 pounds body weight daily, but in these cases a daily total of 1.5 grammes was given.

The results of the agglutination reactions after administration of the drug are interesting, and as far as I am aware have not previously been described. A slow steady fall in the titre occurs. It is also interesting to note that a fairly high rise in T "O" agglutinins in both cases took place.

I am indebted to Lieutenant-Colonel F. Phelan, I.M.S., for permission to forward these notes for publication and to Major H. T. Findlay, R.A.M.C., for the pathological work involved.

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A METHOD OF CARRYING THOMAS' SPLINTS IN MOTOR AMBULANCES.

BY MAJOR T. D. M. MARTIN,  
*Royal Army Medical Corps.*

THE following method has been found satisfactory in preventing loss or damage to the splints, without rendering them inaccessible or diminishing the accommodation available in the ambulance. The splints themselves are hung in a pair of clips, fastened with wing-nuts, to the front wall of the inside of the body over the door which, opening outwards, is not affected. The suspension bars are placed on the floor under the tip-up orderly's seat, and clamped there with wing-nuts. The foot-pieces are clipped to the splints, the pin being tied to both with string. The fittings in our case were made by the unit workshop section at a cost for materials of less than a shilling per car.

I am indebted to Colonel G. F. Dawson, M.C., for permission to submit this note for publication.

### CONGENITAL ABSENCE OF PECTORAL MUSCLES.

By MAJOR F. M. RICHARDSON,  
*Royal Army Medical Corps.*

In the *British Medical Journal* of April 15, 1939, Dr. M. B. Parhad published photographs of a small Armenian boy with congenital absence of the pectoral muscles.

In the accompanying photographs of a soldier aged 22 the same condition is clearly evident. In fig. 2 the hands are being squeezed together against a ruler.

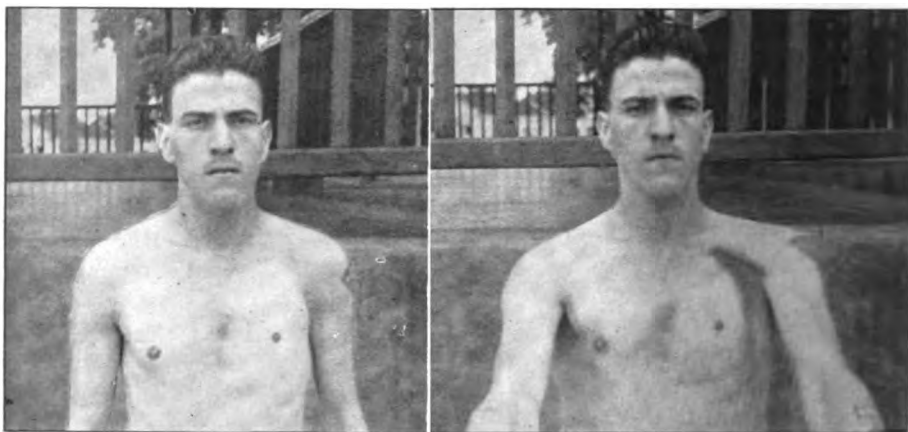


FIG. 1.

FIG. 2.

It is somewhat surprising that the condition was not noticed on enlistment or subsequently.

The only disability caused by the condition is some difficulty in carrying a rifle on the left shoulder. It does not interfere with games or swimming, in which he uses all types of stroke.

As in Dr. Parhad's case, the family history is negative.

### MASSIVE COLLAPSE OF THE LUNG.

By MAJOR P. F. PALMER,  
*Royal Army Medical Corps.*

L/CPL. K., 2nd Suffolk Regiment, aged 22 years, total service four years. India 8-12 years. His history is as follows :—

Appendicectomy was performed on 26.6.37 under general anaesthesia. Patient is said to have taken the anaesthetic badly and for part of the period was "rather deep." Whilst returning on the trolley to the ward he retched but did not vomit, and at the same time became deeply cyanosed for about twenty seconds. Till the evening of 28.6.37 the post-operative period was normal except for a little cough and sputum. That evening I was asked to

see the case, when he gave the following history : After tea, pain began in the left lower chest together with a sensation of tightness, and a feeling of want of air. On examination temperature was  $102^{\circ}$  F., pulse 90. He looked rather worried and breathing was a little distressed ; there was slight cyanosis, apex beat was in the fifth space in the axillary line. There was absence of vocal fremitus and resonance on the left side. Air entry was present but



FIG. 1.

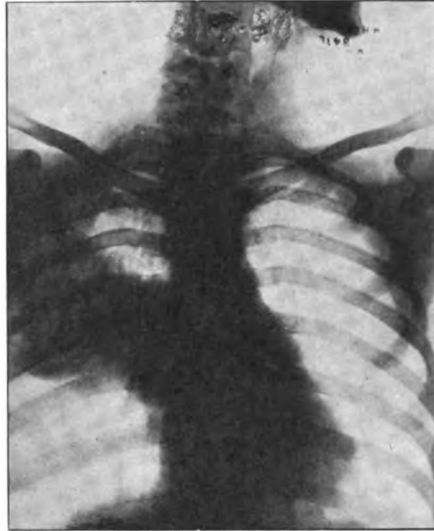


FIG. 2.



FIG. 3.

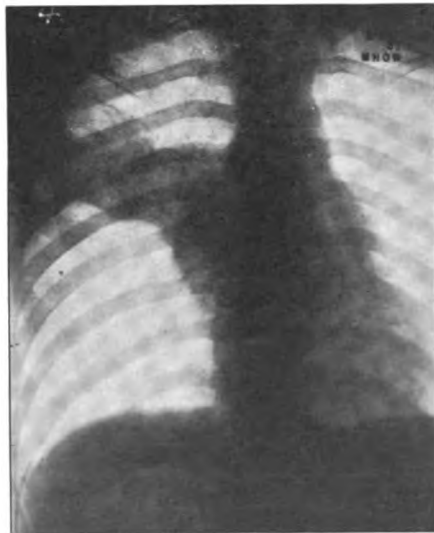


FIG. 4.



extremely poor. There was cough with nummular mucoid sputum. A saline expectorant with ammon. carb. and pot. iodide was given.

During the next nine days patient ran an irregular fever, gradually falling to normal. Sputum was copious, offensive, and purulent. Blood-count on the third day showed a leucocytosis of 17,500, of which 88 per cent were polymorphs. A radiograph on the second day showed total collapse of the left lung with no heart margin to the right of the spine. On the sixth day air entry had returned to the upper lobe and gradually spread throughout the lung, till by the eleventh day there was air entry at the base. At this time the apex beat had returned to 1 inch outside the nipple line. On the fifteenth day sputum ceased altogether.

At the beginning, physical signs were displacement of the apex beat to the side of the collapse, diminished air entry, and absent vocal fremitus and resonance over the whole lung, except at the base of the scapula where tubular breathing was present, due to conduction of breath sounds through the root of the collapsed lung. Sputum was purulent, nummular, and offensive, and at times amounted to 10 oz. in the twelve hours. There was a leucocytosis of 17,000, later almost 19,000, of which 91 per cent were polymorphs. Although air entry had returned to the base on the eleventh day, and the patient had clinically recovered on the twenty-sixth day, nevertheless X-rays still showed some collapse at the base on that date.

#### ÆTIOLOGY.

The ætiology appears to be quite clear. It was due to aspiration of vomitus into the trachea whilst under anaesthesia. This accounted for the temporary cyanosis. The vomitus was then aspirated into the left main bronchus with resultant infection and complete collapse on the second day.

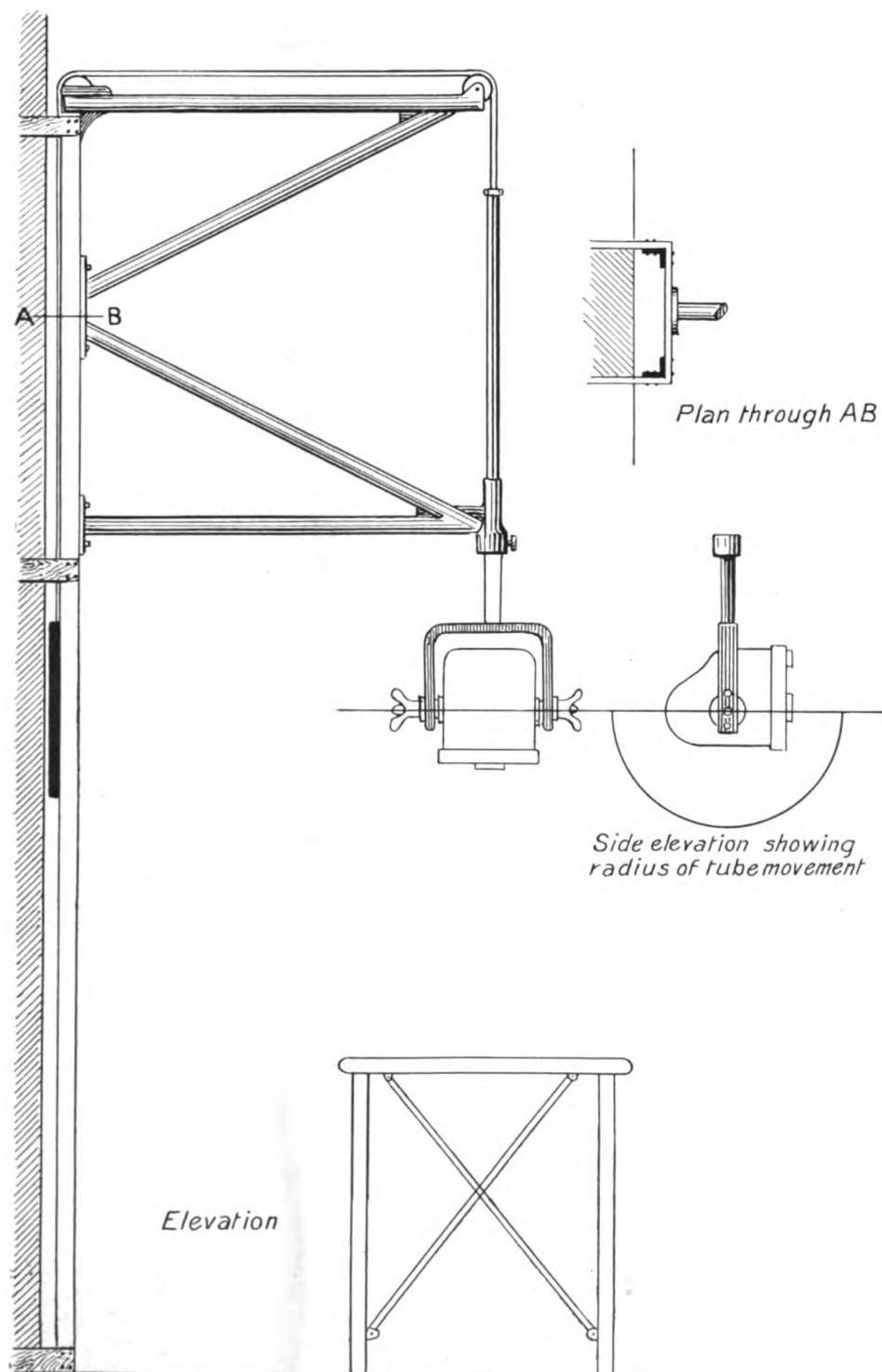
Permission has been kindly granted by Lieutenant-Colonel E. P. Allman-Smith, Commanding British Military Hospital, Mhow, to send these notes for publication.

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#### RADIOGRAPHIC TUBESTAND FOR USE WITH A FIELD SERVICE X-RAY OUTFIT.

BY MAJOR R. B. GUYER, M.B., CH.B., D.M.R.E.,  
*Royal Army Medical Corps (S.R.).*

THE casualty clearing stations of the British Expeditionary Force were issued with field service X-ray outfits primarily designed for the radiography of fractures and the location of foreign bodies. For this object the design was admirable, but drawbacks were encountered in ordinary radiographic work on account of the below-couch position of the tube, and the



Radiographic tubestand for use with a Field Service X-ray outfit.

short focal distance obtainable. A larger focal film distance was desirable on account of the wide scope of the work undertaken in the absence of active hostilities, and to obtain this a tubestand was made locally at a comparatively small cost.

A gallows was constructed from gas piping carrying a collar, through which a tube ran, locking being provided for by means of a winged nut in the collar. A counter weight was attached to this rod by means of a flexible galvanized wire which ran across two overhead pulleys, the weight being allowed to run free behind the stand. At the lower end of this "tube rod" a double arm was made with two hooks at the lower end of the limbs, and these were an exact copy of the original below-couch arms designed for carrying the "tube head" in that position. The upright stand was constructed of two lengths of angle iron bolted together at suitable points in order to carry the arms of the gallows, and the whole was fixed to the wall by means of iron plugs.

The various movements obtainable from this simple contrivance are obvious from the diagram.

(1) The vertical movement of the tube depends on the length of the rod running through the collar in the lower arm of the gallows, and in this particular unit sufficient length has been allowed to enable stretcher and bed cases to be radiographed without the necessity of being lifted on to the table.

(2) For lateral radiographs the table or bed could be moved towards either side as necessity arose, the tube being pulled down and rotated to the required position; this was found most useful in fractures of the lower limbs where it was impossible to move the patient on to his side.

(3) Rotary and tilting movements were obtained in the same manner by adjusting the angle of the "tube head" and this was found to be quite sufficient for any skull or sinus radiography.

(4) For distance work, such as chest radiography, the stand was fixed to the wall in such a manner, that when the tube was pulled down and rotated it was exactly five feet from a wooden screen on which a cassette could be fixed by means of studs at any required level and thus upright chest radiography could be easily obtained.

(5) When necessary the "tank head" could be detached in a few minutes from the above-couch position, and replaced in its normal below-couch site; this could easily be undertaken by one man.

In this particular case the table and stand were earthed separately; some form of separate or combined earthing is obviously necessary.

I would like to thank Lieutenant-Colonel R. B. Myles, *O.B.E.*, *R.A.M.C.*, for his encouragement in the work of this department and for suggesting that a description of this piece of apparatus should be submitted for publication.

## Echoes of the Past.

### LIFE IN A C.C.S. DURING THE GREAT WAR.

BY LIEUTENANT-COLONEL L. T. CHALLENGOR,  
*Royal Army Medical Corps.*

A paper read before the British Medical Society of the Dieppe area, on Wednesday,  
January 17, 1940.

GENERAL PRIEST AND GENTLEMEN—

I am a voice from the past. I am relying largely on my memory to give you some idea of how we lived and how we worked during the Great War.

What is a C.C.S.? Let us consider this question at the outset. A C.C.S. is primarily a unit, the function of which is to receive and clear casualties from the forward areas and evacuate them to the rear where, under safe surroundings, their injuries can receive appropriate treatment. That, I think, briefly but fairly describes the original function of a C.C.S., and prior to the Great War a C.C.S. was not regarded as anything other than a clearing station. Circumstances, however, alter cases, and what I hope to do, in the time at our disposal, is to show how the C.C.S. developed into what was, I think, the most important unit in the Medical Service, so far as the treatment of the casualty was concerned. To a large extent I must rely on my memory, and it must be realized that one's memory for things over twenty years ago is liable to play one tricks.

My experience of work in a C.C.S. started in 1916. A C.C.S. had then developed, as a result of the experience of the treatment of the wounded during the previous year and a half, and it had now become a unit at which early and efficient surgical treatment could be given. This development was made possible because, after the initial war movement in 1914, stationary warfare resulted, and so, like other units in the field, the C.C.S.s dug themselves in, built wards and operating theatres, and took up more or less permanent positions. By the end of 1915, and early in 1916, the C.C.S. was working not only as a clearing station, but as an operating theatre, standing behind the lines, and receiving casualties within a few hours of wounding.

The late Sir Anthony Bowlby, who was Consulting Surgeon to the B.E.F., played a very large part in this development. The C.C.S. to which I belonged consisted of a central block containing the office in the middle, the officers' ward at one end and the theatre and sterilizing room at the other. Around this central block were the various wards, both wooden and Nissen, with revetments of earth between to act as protection against bombing. Just outside the theatre was a small square hut known as the "Wendy Hut"; this was the office of the Sister in charge. A road ran up to the reception room bringing cases right up to the entrance.

Our mess was a house opposite the station. Ambulance trains drew up at the siding on the opposite side of the road and stretcher cases were easily carried by hand from the C.C.S. to the train.

Our reception room was divided up for receiving walking and lying cases, and a portion of it was screened off for the performance of minor operations, dressings, etc. The casualties came in unceasingly, sometimes in small numbers, sometimes in overwhelming numbers, and from the reception room were distributed to the appropriate wards, after their particulars had been taken. The wards to which they went were the pre-operation ward, the resuscitation ward, the moribund ward, and the evacuation ward. Those casualties that went to the pre-operation ward were cases requiring surgical treatment and who were fit to take their turn in the theatre. They were undressed, washed and shaved, but left on their stretchers, being removed from the stretcher on arrival in the theatre, where they were placed straight on the operating table. To the resuscitation ward went those shocked, those pulseless, ex-sanguine cases, whose condition was too serious for surgical intervention until such time as they had recovered from the initial collapse, and it was the duty of the medical officer in charge of this ward to see that they came to the theatre in the best condition possible. To the moribund ward went those cases who were obviously dying.

It will be quite obvious that whoever is in charge of the pre-operation ward and the resuscitation ward must have very considerable experience. This is one of the most important jobs in a C.C.S. and will remain so. Choice of cases for evacuation was not always easy, and we had always to remember that the function of a C.C.S. had changed, the evacuation of casualties was still of the greatest importance, and for a C.C.S. to work at its maximum efficiency, its evacuation schemes as well as purely surgical schemes had to be planned and carried out, for it was no good a C.C.S. doing good surgical work coupled with poor evacuation or vice versa. Evacuation had also to be considered with the number accumulating for the theatre, for there must always be a limit to the number of cases with which a theatre can successfully deal.

The three great evil influences which had to be combated were shock, hæmorrhage, and sepsis. Of the three I think we found shock the most difficult and disheartening to deal with. Hæmorrhage was treated by intravenous saline and gum saline; with blood transfusion rapidly coming up to take their place. We chose our donors from our convalescent patients, and a transfusion was usually done in the theatre. The blood was not drawn from the vein through a needle; the vein was exposed, ligatures passed behind it and left untied, an incision made into the vein and a glass cannula inserted, the blood being drawn off into a vessel containing citrate. The same procedure was carried out on the recipient, and the blood run in.

I have, in these operation books, several cases which indicate the good results we obtained.

(Here several cases in which this type of blood transfusion was practised, were given.)

Our other bugbear, sepsis, is worth mentioning, especially in connexion with gas gangrene. For this we were always on the lookout, and the true gas gangrene case was one to be feared, but on looking through what records I have, and remembering other cases, I cannot say that gas gangrene was a common occurrence ; cases of query gas gangrene, yes, but true gas gangrene, no ; in fact any case of suspected gas gangrene was sufficient to bring us all to the theatre to see it.

We relied on the following points when we were considering a case of suspected gas gangrene :—

- \* (1). A muscle deprived of its blood supply will not bleed when cut, and will die.
- (2). A dead muscle neither contracts nor bleeds.
- (3). A muscle in the first steps of invasion by anaerobes loses its normal resilience and has a brick-red colour.
- (4). In the later steps of invasion the muscle becomes crepitant, and exudes a dark, reddish-brown, foul smelling fluid.

I have a note taken at our C.C.S. on antigas gangrene serum ; it reads as follows :—

“ The following are notes taken of the few cases treated since March 28, 1918, with Bull's serum. In addition there were a few cases treated by Major Bull himself. As regards the polyvalent antigas gangrene serum, left by General Wallace in the third week of April, and sent to him by Colonel Elliott, no case has occurred since that date of developed gas gangrene infection, suitable for its trial, and it was not considered expedient in any case in which frank gas gangrene had not developed.”

I have not the date on which the note was written, but it cannot have been earlier than June, 1918, and it therefore shows that at least for two months no case of obvious gas gangrene occurred. I am not concerned in this paper with what the present treatment will be, should we have to deal with such cases.

To come back to our C.C.S. We have received the casualties and they have been distributed. All this time the theatre was at work. There was always something to be done, sometimes there was so much as to make one despair of ever getting through it. We were organized in teams, a surgeon, anaesthetist, sister, and two O.R.A.'s, together with half a dozen

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\* Captain C. H. Upcott, R.A.M.C., “ Surgical Treatment of War Wounds in Medical Units of the Third Army.”

stretcher bearers. The sisters acted as assistants and rattling good assistants they were ; the anæsthetists were sisters and many of them were good at the job.

The number of casualties coming in determined the number of tables working in the theatre. We could, and did, often run four tables, for we were always busy stationed as we were behind Arras, and taking in from that front and also from Vimy. Because of this, it was not often that we were sent to help other C.C.S.s ; more often we had surgical teams to help us.

I was away three times in two and a half years, once to help the Australian C.C.S. at Steenwerke and the Messines Ridge show in June, 1915, and although I was only a few miles away when the mines went up I never heard them, and once to Aire where II Stationary Hospital were right up acting as a C.C.S., and once to the Canadian C.C.S., in 1918. We travelled in three ambulances, with a complete equipment, and we were able on arrival to be ready to operate within the hour. I can well remember speeding the departure or welcoming the arrival of travelling teams. There was never any lack of work in the C.C.S., often too much, and our periods of duty were sometimes long. We have worked for twenty-four hours or more, with practically no rest. During the Arras Battle in 1917, we worked for weeks, sixteen hours on, eight off, and I remember that very well, because out of the hat I drew as my tour of duty 4 a.m. to 8 p.m., and if I may advise anybody who has to do that in the near or distant future, I would say turn night into day, and at 8 a.m., having seen the patients on whom you have operated, are all right, go straight to bed having ordered breakfast, a real breakfast of bacon and eggs, coffee, toast and marmalade, for 3.30 p.m. Then go to the theatre feeling thoroughly "morningish," and get through your tour of duty well.

Our primary job in the theatre was to save life, and to operate as quickly as possible. The theatre at the C.C.S. was no place for the slow operator, for admissions accumulated so quickly as to make it impossible, especially during the big battles, to cope with them, and many cases had to be sent down to the Base who would undoubtedly have benefited by early treatment in the C.C.S. I well remember how even one case of multiple wounds held up the work and how two of us or even three would work on the one man in order to shorten his time on the table and so give him his chance of surviving. Bombs were the cause of multiple wounding in most cases. Painful dressings requiring anæsthetics also held up the work in the theatre. We soon learned the value of the impromptu consultation in the theatre, and more often than not these consultations were on the fractured femurs, the problem before us being whether or not to amputate. The value of co-operation between the surgeons in the theatre of a C.C.S. cannot be over-estimated. It was very seldom that we saw the case for operation until it was on the table, and often the patient had been anæsthetized before we knew what his condition was. This certainly led to variety.

May I now say a few words about the "follow-up" of cases.

It is, I think, of the greatest importance that the surgeon at the C.C.S. should know the result of his labours. The Medical Research Committee issued cards; I have some here for your inspection. The cards were filled up with brief notes by us and accompanied the patient down the line to the Base and to England. They were returned to us completed at each stage, and so, in many cases, we were able to see what was the ultimate fate of our patients. The cards were of the greatest value, and we used them freely. I feel sure you will be interested in them. I am sorry that they are all the cases of one surgeon, but that I cannot help. On looking through these records of twenty years ago I am compelled again to pay tribute to our very efficient theatre clerk whose care and thoroughness in record-taking was of the greatest benefit to us.

Even in quiet times we would get thirty cases in the operating theatre during the day, not all severely wounded, but all requiring surgical treatment. Different methods of treatment were tried: the salt-pack, the flavine pack, the soap-pack, the paraffin pack, Carrel tubes and bipp, but the fundamental principle, which gave good results, was free excision of all damaged tissue and thorough cleansing of the wound, and in 1918, with Sir Cuthbert Wallace, then Consulting Surgeon to the First Army as our guide, philosopher and friend, we were steadily heading to a line of treatment in which asepsis was supplanting antisepsis.

Life at a C.C.S. was a happy one, and a busy one. We at a C.C.S. always claimed it to be the best medical unit in which to serve. The field ambulances naturally did not agree with us, but there can be no doubt that the opportunities for service at a C.C.S. are unsurpassed. For the keen surgeon, who is a quick operator, and capable of making quick decisions, and has youth and vigour to withstand the long hours and the strain involved, there is no finer unit with which to serve. I knew no C.C.S. where the spirit of the place was not one of cheerfulness, optimism, and of co-operation, and I remember the days I spent in my own C.C.S. with thankfulness and gratitude, on having been able to have the opportunity of service there.

Whether the C.C.S. of the future, either near or distant, will be a replica of the C.C.S. I knew, I cannot say. It seems that this will largely depend on the type of warfare we have to meet, but whatever type of work the C.C.S. is called upon to do it must, I think, always be one of the most important points in the whole medical machinery. I realize that there must be many omissions in this short sketch of the C.C.S. as I knew it, but I hope that I have been able to give you some idea of how we lived, and how we worked, during the war of 1914-18. The Great War to end war?

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### ENEMY TROOP CARRIERS.

THE War Office has asked us to publish these pictures of German troop carriers to help the public to distinguish enemy aircraft.

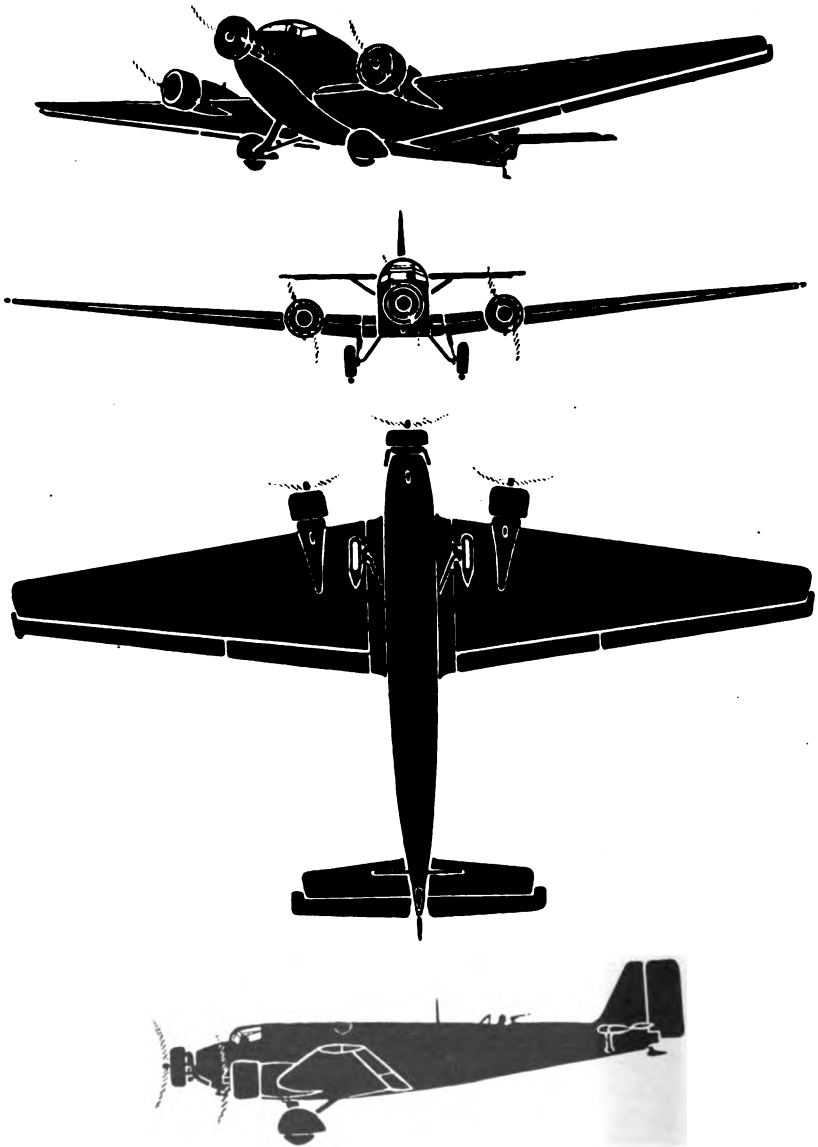


FIG. 1.—Junkers Ju. 52 (B.M.W. engines). Dimensions : Span 96 ft. ; length 62 ft. Distinctive features : (i) Three engines ; (ii) low wing ; (iii) single square-cut rudder ; (iv) sharply tapered wings ; (v) square-cut wing-tips and tail plane ; (vi) fixed undercarriage.

*Note.*—Most important German troop-carrier, and the one normally used for parachute dropping.

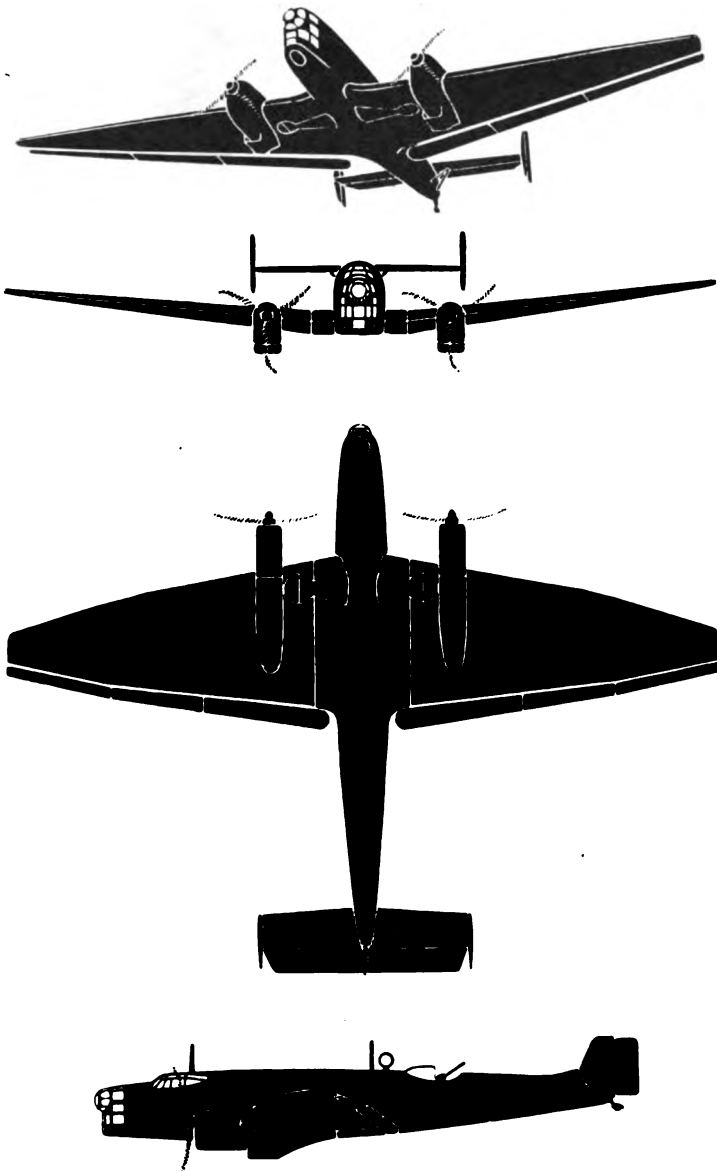


FIG. 2.—Junkers Ju. 86 (Jumo engines). Dimensions : Span 73 ft. 8 in. ; length 57 ft. 4 in. Distinctive features : (i) Two engines ; (ii) low wing ; (iii) two square-cut rudders ; (iv) sharply tapered wings ; (v) square-cut wing-tips and tail plane ; (vi) retractable under-carriage.

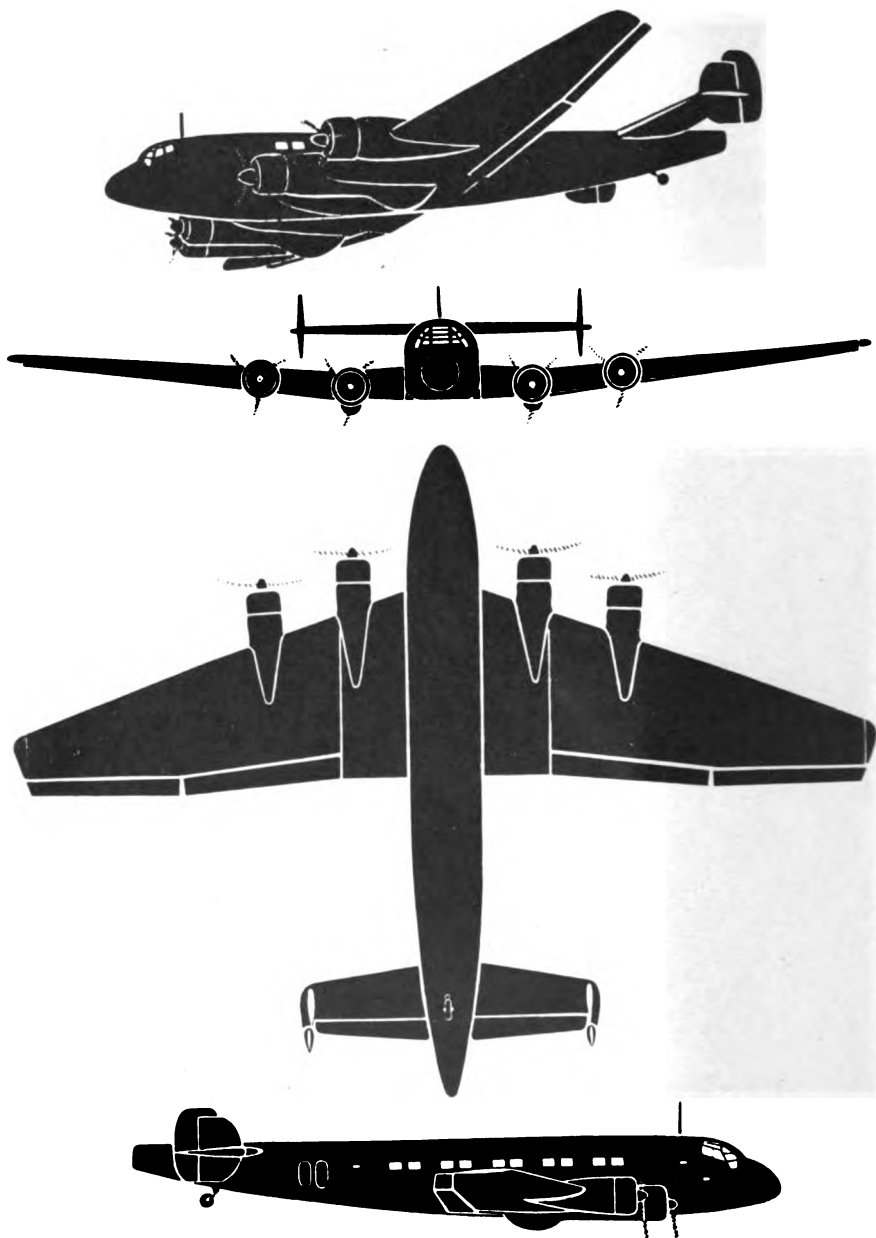
*Enemy Troop Carriers*

FIG. 3.—Junkers Ju. 90 (B.M.W. engines). Dimensions: Span 115 ft.; length 86 ft. Distinctive features: (i) Four engines; (ii) low wing; (iii) two rudders; (iv) tapered wings; (v) leading edge of wing has very pronounced "sweep-back"; (vi) square-cut wing-tips and tail plane; (vii) retractable undercarriage.

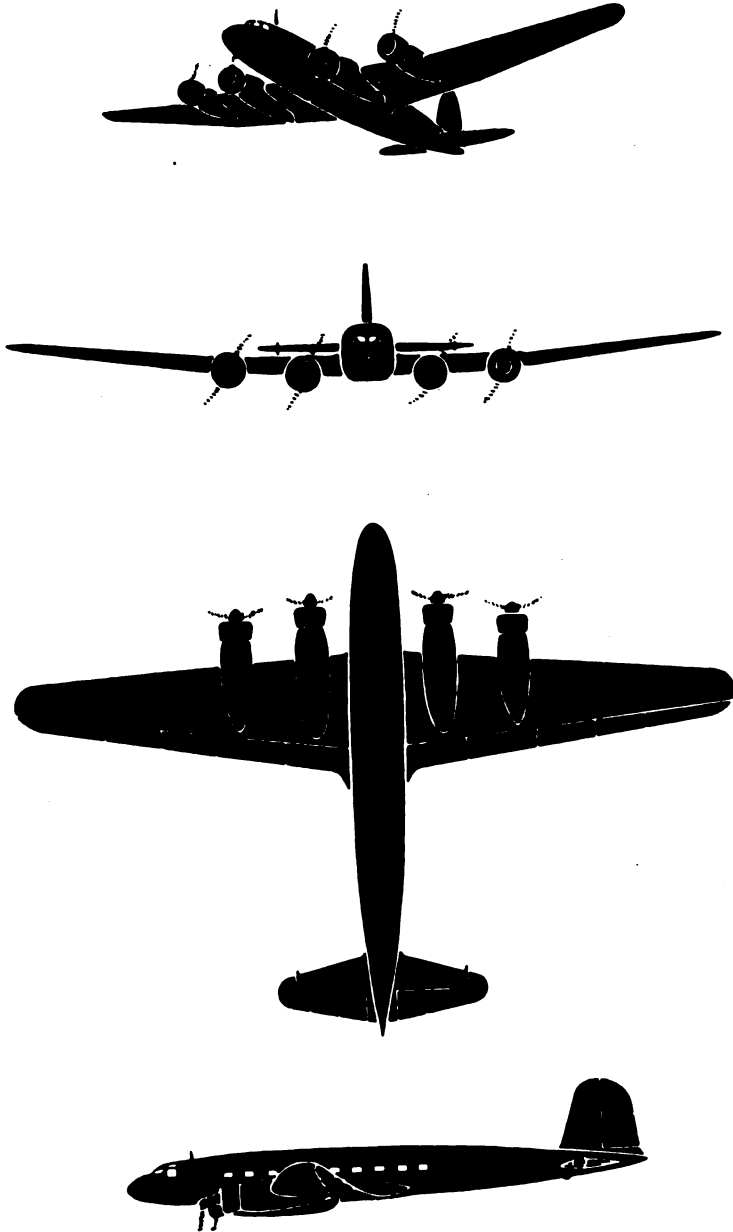


FIG. 4.—Focke-Wulf 200 "Condor" (B.M.W. engines). Dimensions: Span 108 ft.; length 78 ft. Distinctive features: (i) Four engines; (ii) low wing; (iii) single rudder; (iv) tapered wing; (v) rounded wing-tips and tail plane; (vi) retractable undercarriage; (vii) smooth streamlined fuselage.

## Current Literature.

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OGILVIE, W. H. **Surgery of Infected Wounds.** *Lancet.* 1940, May 18.

Mr. Ogilvie, surgeon to Guy's Hospital, has contributed to the *Lancet* three long articles on the Surgery of Infected Wounds. He writes that the principles of the prevention and treatment of wound infection so far as they concern the surgeon are: (1) To avoid the contamination of intentional wounds; (2) to decontaminate accidental wounds before infection develops; (3) in infected wounds to assist the natural processes by which infection is being fought.

After discussing the methods of sterilization usually employed for the theatre and dressings and the technique for the surgeon, he points out that bacteria on the skin may be chance organisms lying on the surface or deeper in the skin. The first can be removed by washing and mechanical means, but the second are not so easily got rid of. The antiseptics which seem most potent in sterilizing the skin are Tinker and Sutton's solution of acriflavine, Bonney's blue, Harrington's solution of mercuric chloride, and dettol. Picric acid may cause severe dermatitis and is unsafe.

**Air-borne infection:** The air of a theatre will contain organisms from two sources—those carried in the floating dust and those distributed in droplets from the upper respiratory passages of persons in the room. In modern theatre blocks dust is eliminated. The theatre is empty except for the table and instruments; there are no windows and an air-conditioning plant satisfies the needs of air sterilization, ventilation, and temperature regulation. Droplet infection of streptococci from some member of the operating team must be guarded against by the use of an efficient mask. The prevention of infection implies not only the exclusion of bacteria from the wound, but leaving the tissues in a state to undertake repair rapidly. This object is attained by clean cutting, rather than blunt dissection, interfering with nerve and blood supply as little as possible, and avoiding hæmorrhage.

Accidental wounds differ from operation wounds in that bacteria are present and the surface of the wound is somewhat devitalized. Wounds produced by weapons are contaminated but not infected at first, or for some six hours; if within six hours we can convert a contaminated wound into a healthy one by removing dirt, bacteria, foreign bodies, and devitalized tissue, we convert it into a healthy surgical wound and it will heal by first intention. After twelve hours we are unlikely to get clean healing and it is wiser not to attempt it.

Whether a wound can be excised depends on many factors—military, administrative, and surgical. In desultory fighting the majority of cases will reach the C.C.S. in time, but in a battle of movement the majority will

not. Once the wounded reach the C.C.S. the number which can be dealt with before the period of grace expires depends on perfection of arrangement. The maximum rate of work for a surgeon trained in C.C.S. work and assisted by a skilled team is about three cases an hour, so that he cannot deal with more than twelve to fifteen cases in the safe period.

After débridement primary suture can be considered in a limited number of cases of battle casualties where the débridement has been early and complete, where the circulation is satisfactory and the patient can be kept under observation for at least a week. It should not be attempted in deep wounds and in those reaching the surgeon after six hours. After dressing, the wound and its neighbourhood must be kept completely at rest and immobilization secured by a plaster case. The wound should be packed evenly and firmly with strips of gauze soaked in 1 : 1,000 proflavine solution. Over the gauze-pack an abundant dressing is applied and the limb is then bandaged over the whole segment to apply firm pressure, and immobilized in a plaster case.

The Carrel method of intermittent irrigation has advantages over packing, but its drawback is that it requires constant attention. While too elaborate and exacting for the treatment of war injuries, it has a definite place in normal hospital practice where the proportion of nurses to patients is adequate and evacuation is not a pressing need.

The basic principles of war surgery are simple—excision, drainage, and immobilization are the basis of all wound treatment. The application will depend on the number and condition of the wounded. In heavy fighting the wounded will arrive in large numbers—dirty, tired, hungry, and thirsty. often several days since they were hit. Under such conditions the method of free drainage and fixation in plaster of Paris is supreme. Ogilvie writes : “The one advantage of plaster over any other method of fixation, and in certain circumstances it is an overwhelming one, is that it is fool-proof. Once a wounded man has undergone efficient surgical treatment, and has been put in plaster he is safe ; he may be blown out of an ambulance, derailed in a train, crushed in an aeroplane, or torpedoed at sea, he may be left for weeks in a cellar . . . but so long as his plaster holds he will come to no harm.” This was written before the B.E.F. began its withdrawal, and medical services in Flanders have struggled to do their work under incredible difficulties. In these conditions the closed plaster method has come into its own. In heavy fighting it has many advantages ; it greatly simplifies the supply and distribution of splints, for a stock of plaster does the work of apparatus of many types. It implies a sealed dressing that cannot be changed without removing the plaster and thus protects a man who has escaped the dangers of primary anaerobic infection from the risks of secondary streptococcal infection. It is applicable to all wounds that have been properly excised and is contra-indicated only when damaged tissue that may undergo necrosis remains in the wound, or where there is any vascular damage.

Ogilvie considers that the power of sulphanilamide to combat an established infection, and the still more remarkable power if administered shortly before the entrance of infection to prevent its establishment, may be taken for granted. He recommends that the sulphanilamide should be given as suggested by Fuller and James, which we described in the May number of the *JOURNAL*. Ogilvie writes that the fear that the drug may aggravate to a dangerous degree the collapse of a patient already shocked seems to be belied by the experience of American surgeons in the treatment of severe automobile accidents. The only practical objection to the routine use of sulphanilamide is the doubt whether primary streptococcal infections are sufficiently common to justify a course that may add to the difficulties of administration in the forward areas. The place of chemotherapy in established infections is too well recognized to need elaboration.

Sulphanilamide is recommended as a local application for recent wounds only. According to Battle not more than 15 grammes should be used in the dressing to avoid the risk of toxic symptoms from absorption, and oral administration in the case of established infection should be started after forty-eight hours, by which time the drug absorbed from the wound has been largely eliminated.

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## Reviews.

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**SHELL SHOCK IN FRANCE, 1914-1918.** By Charles S. Myers, C.B.E., F.R.S., sometime Consultant Psychologist to the British Armies in France. Cambridge University Press. 1940. Pp. xi + 146. Price 4s. 6d.

Dr. Myers has written this short book basing it on a war diary which he kept during the 1914-18 war period. He expresses the hope that it will exercise some guiding influence on the senior administrative officers of the Army Medical Service and the Adjutant-General's Department, and believes that it will be of assistance to the younger members of the R.A.M.C. The reviewer feels that the first of these hopes is more likely to be realized than the second.

The medical history of the last war is not very satisfactory in its record of the procedures undertaken to deal with the war neuroses, and that is clearly unfortunate since this group of disorders, while relatively small in numbers, compared to wounds, was quite disproportionately costly to the taxpayer both during that war and through all the years which have succeeded it. Dr. Myers, whose training was primarily along the lines of experimental psychology, began his work as a Consulting Adviser in France early in 1915 and had a great deal to do with the arrangements in France and in England until he was demobilized in 1919. There are many historical facts in this book which are worthy of being recorded and which are of

considerable interest and importance. Dr. Myers sounds somewhat pessimistic and disappointed about much that was done then. It should be some consolation to him and some reassurance to his readers to realize that the Army Medical Service has in this war profited by many of the mistakes and shortcomings of the last war.

This book gives the impression of having been put together rather hurriedly, so that even the historical material is rather diffuse and repetitive. This applies even more to the sections on psychopathology and treatment, which are not enlightening either for the novice or the expert. The terminology which Dr. Myers uses has not been modernized in any way and his style of writing suggests a lack of understanding and conviction illustrated by the fact that nearly every descriptive word is placed in inverted commas: "somatic," "psychical," "apparently normal," "functional," "emotional." On one page alone there are thirteen of these literary unpleasantnesses.

Despite these criticisms it is a good thing that Dr. Myers has looked up his diaries and produced some historical facts which might otherwise have been lost.

**TUBERCULOSIS OF THE UPPER RESPIRATORY TRACTS.** By F. C. Ormerod, M.D., F.R.C.S. London: John Bale Medical Publications Ltd. 1939. Pp. vi + 215. 2ls. net.

This treatise, based on sixteen years' experience at the Brompton Hospital, is excellent both in its narrative and illustrations, and should find its place on the book-shelves of all those interested in the clinical problems of pulmonary tuberculosis.

In his preface Dr. Ormerod pays a graceful tribute to the help afforded him at different stages of his career by those two great pioneer laryngologists, Sir James Dundas Grant and Sir StClair Thomson, whose advice and teaching he has put to such excellent use in this very readable account of what is to many of us a difficult and almost unexplored territory of Medicine.

We all know in a general way that tuberculosis of the larynx is an important and prognostically serious complication of phthisis, but most of us, I am afraid, have a very hazy idea concerning which parts of the larynx are chiefly affected and what the lesions look like. Dr. Ormerod has, as far as is humanly possible in a book, lifted the veil and has told us with the aid of clear description just which parts—epiglottis, vocal cords, arytenoids, ventricular bands, etc., bear the brunt of the attack, and has also *shown* us with the aid of a series of remarkably clear illustrations in colour from the brush of Mr. Dennis Mathew just what we should see if confronted with a case and a laryngoscope (that is if we could use this).

As proof that tuberculous laryngitis is a not unimportant complication of phthisis, mention is made of the fact that 25 per cent of all cases of pulmonary tuberculosis suffer from it. The proportion is much less in children, however, and in one large series of cases under 20 years of age only 5.6 per cent were thus affected.



That the prognosis of a phthisical patient is adversely affected by complicating disease of the larynx is graphically epitomized by Sir StClair Thomson, who is quoted as saying that "after the lapse of an equal number of years two out of every three patients with tuberculous laryngitis will be dead, while two out of three phthisical patients with normal larynxes will still be alive."

Whilst the death-rate of all cases of phthisis with a normal larynx is 37.5 per cent, in the case of those with tuberculous laryngitis it has soared to 70.6 per cent.

The symptoms of this serious complication of phthisis (it may be said never to occur apart from disease in the lungs) are, in order of frequency, but in reverse order of gravity: Hoarseness, pain, and dyspnoea.

The pain is of two types; one, the least important, is the general ache inherent in an inflamed and congested organ and is felt chiefly during and after using the voice.

The second variety of pain, prognostically much more serious, and also very difficult to treat, is caused by the passage of food over an ulcerated surface. The dysphagia thus caused leads to the vicious circle of progressive unwillingness to eat, with consequent progressive debility and loss of weight.

A mixture of anæsthesin (benzocaine) and orthoform (orthocaine) blown on to the ulcerated area by an ordinary glass insufflator, which the patient learns to manipulate himself, forms the most effective local application.

In contrast to the high incidence of tuberculous laryngitis (25 per cent) in phthisis, is the relative rarity of tuberculous pharyngitis, only one half of 1 per cent. This very serious complication is evidence of severe, usually bilateral, disease of the lungs, and the prognosis is uniformly bad.

In addition to the chapters on tuberculosis of the larynx which, in view of its relative importance and frequency, occupy the lion's share of his book, Dr. Ormerod has included useful chapters dealing with tuberculosis of the pharynx and adnexæ, the trachea and bronchi, the œsophagus, the nose, and the ear, all well illustrated by coloured diagrams.

Dr. Ormerod and his artist collaborator are to be congratulated on a valuable contribution to this special branch of Medicine.

S. S.

The following book has been received:—

WIDE FIELD X-RAY TREATMENT. By S. Gilbert Scott, M.R.C.S., L.R.C.P., F.F.R., D.M.R.&E.Camb. (Nuffield Wide Field X-Ray Research). Bristol: John Wright and Sons, Ltd. 1940. Pp. viii + 714. 17s. 6d. net.

**Notice.**

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# JOURNAL OF THE ROYAL ARMY MEDICAL CORPS

## Corps News.

JULY, 1940.

### EXTRACTS FROM THE "LONDON GAZETTE."

May 24.—Lt. (Or.-Mr.) W. N. Collier to be Capt. (Or.-Mr.). May 25, 1940.

May 28.—Col. J. E. Ellcome, late R.A.M.C., retires on ret. pay May 26, 1940, and remains empld.

Lt.-Col. (actg. Col.) A. A. M. Davies, from R.A.M.C. to be Col., May 26, 1940, with seniority Dec. 26, 1937.

Maj. W. D. Anderton, M.C., M.B., to be Lt.-Col. May 26, 1940.

May 31.—Col. (actg. Maj.-Gen.) H. H. Blake, O.B.E., M.B. (late R.A.M.C.) retires and remains empld. May 30, 1940.

Lt.-Col. L. Dunbar, O.B.E., M.B., from R.A.M.C., to be Col. May 30, 1940, with seniority Jan. 13, 1938.

Maj. C. M. Forster to be Lt.-Col. May 30, 1940.

Lt.-Col. A. E. B. Wood (10514) (late R.A.M.C.) (ret. pay) at his own request, relinquishes the rank of Lt.-Col. whilst empld. in the temp. rank of Maj. April 15, 1940.

June 4.—*Short Service Commissions*.—Capt. R. Phillipson (65499) is appointed to a perm. commn. June 1, 1940, retaining his present seniority.

The appts. of Lts. W. B. Foster, M.B., (90093), W. L. O'Donnell (90092), and N. F. Field, M.B. (42270), are ante-dated to Sept. 18, 1938, Oct. 1, 1938, and Feb. 1, 1939, respectively, under the provs. of Art. 39, Royal Warrant for Pay and Promotion, 1940, but not to carry pay and allces. prior to June 1, 1939.

The undermentioned Lts. to be Capts., June 1, 1940 :—

W. B. Foster, M.B., with seniority, Sept. 18, 1939.

W. L. O'Donnell, with seniority Oct. 1, 1939.

N. F. Field, M.B., with seniority Feb. 1, 1940, and precedence next below Capt. J. A. Farrell.

June 2, 1940 :—

G. P. Crean (85868), with seniority Feb. 1, 1940, and precedence next below Capt. H. L. Wolfe.

June 7.—*Short Service Commission*.—The appt. of Lt. (temp. Maj.) P. R. Wheatley, M.B. (52033) is ante-dated to May 1, 1939, under the provs. of Art. 39, Royal Warrant for Pay and Promotion, 1940, but not to carry pay and allces. prior to May 1, 1939.

Lt. (temp. Maj.) P. R. Wheatley, M.B. (52033), to be Capt., May 1, 1940, with seniority May 1, 1939, and precedence next above Capt. T. O. McKane, M.B. (Substituted for the notfn. in the *Gazette* of May 7, 1940.)

June 11.—*Short Service Commission*.—The appt. of Lt. R. L. Macpherson, M.B. (89932), is ante-dated to May 1, 1938, under the provs. of Art. 39, Royal Warrant for Pay and Promotion, 1940, but not to carry pay and allces. prior to May 1, 1939.

Lt. R. L. Macpherson, M.B. (89932), to be Capt., May 1, 1939, with seniority May 1, 1939, and precedence next below Capt. T. O. McKane, M.B. (89978). (Substituted for the notfn. in the *Gazette* of May 7, 1940.)

June 14.—Capt. L. C. Card (65784), a Short Service Off., is apptd. to a perm. commn. June 14, 1940, retaining his present seniority.

### Regular Army Reserve of Officers.

May 28.—Capt. W. T. Birmingham, M.B. (63165), ceases to belong to the Res. of Off. on account of ill-health, May 29, 1940.

June 7.—Maj. J. S. B. Forbes, M.B. (23050), ceases to belong to the Res. of Off. on account of ill-health, June 8, 1940.

May 21.—Lt.-Col. J. C. Barrett, V.C., T.D., M.B., B.S., F.R.C.S.Eng. (21885), Leicester R., to be Maj. with seniority Aug. 20, 1934, and relinquishes the rank of Lt.-Col. Jan. 26, 1940. (Substituted for the notifn. which appeared in the *Gazette* (Supplement) dated Feb. 20, 1940.)

Maj. H. K. Griffith, T.D., M.B., F.R.C.S. (25853) relinquishes his commn. on account of ill-health, and retains his rank with permission to wear the prescribed uniform, May 22, 1940.

Lt. W. A. Law, M.B., F.R.C.S. (79458), to be Capt. Dec. 20, 1939, with seniority, June 20, 1938.

Lt. J. Black (78581) relinquishes his commn. on account of ill-health. Dec. 30, 1939. (Substituted for the notifn. in the *Gazette* (Supplement) dated Nov. 28, 1939.)

Lt. (War Substantive Capt.) H. S. Gaussen (78349) relinquishes his commn. on account of ill-health. Apr. 22, 1940. (Substituted for the notifn. in the *Gazette* (Supplement) dated Apr. 24, 1940.)

May 24.—Lt. (War Substantive Capt.) C. T. Barry (89533) relinquishes his commn. on account of ill-health, May 25, 1940.

Lt. (War Substantive Capt.) C. G. Jones (87785) relinquishes his commn. on account of ill-health, May 25, 1940.

Lt. C. D. Preston, M.B. (90167), to be Capt. May 20, 1940, with seniority Nov. 20, 1938, next below Capt. E. Foster.

Lt. W. R. Gauld, M.B. (90223), to be Capt., May 22, 1940, with seniority, Nov. 22, 1938.

Lt. F. McC. Thomson, M.B. (94087), to be Capt., May 24, 1940, with seniority Nov. 24, 1938.

May 28.—Maj. J. L. Menzies, M.C., M.D. (51086), from T.A. Res. of Off. to be Maj. Sept. 2, 1939. (Substituted for the notifns. in the *Gazettes* (Supplements) dated Sept. 26, 1939, and Apr. 26, 1940.)

William Chalmers, M.B. (96349) (late Cadet Corpl., Leeds Gram. Sch. Contgt., Jun. Div. O.T.C.), to be Lt., May 5, 1939. (Substituted for the notifn. in the *Gazette* (Supplement) dated Sept. 14, 1939.)

June 4.—Capt. C. Shaw-Crisp (28488) relinquishes his commn. on account of ill-health, May 11, 1940. (Substituted for the notifn. in the *Gazette* (Supplement) dated May 10, 1940.)

June 11.—Lt. J. D. N. Nabarro, M.B. (91235), to be Capt., June 3, 1940, with seniority July 29, 1939, next below Capt. R. M. Johnstone, M.B.

June 14.—Lt. W. J. Dunn (96767), relinquishes his commn. on account of ill-health, June 15, 1940.

May 21.—*Short Service Commissions*.—The undermentioned Lts. (on prob.) are confirmed in their rank :—

J. C. Coe (85289).

L. C. Purnell (95707).

G. B. Zachary (92464).

The undermentioned Lts. to be Capts. :—

J. C. Coe (85289), May 15, 1940, with seniority Dec. 15, 1939.

L. C. Purnell (95707), May 10, 1940.

G. B. Zachary (92464), May 22, 1940.

May 24.—*Short Service Commission*.—Lt. L. C. Purnell (95707) to be Capt., May 18, 1940. (Substituted for the notifn. in the *Gazette* of May 21, 1940.)

May 28.—Maj. D. H. W. Williamson (1971) having attained the age limit of liability to recall ceases to belong to the Res. of Off. (May 29, 1940.)

May 31.—*Short Service Commission*.—Lt. (on prob.) N. L. Fraser (93293) is confirmed in his rank.

Lt. N. L. Fraser (93293) to be Capt., June 1, 1940.

*Temporary Commission*.—Lt. G. Fryer (107889) resigns his commn., June 1, 1940.

June 7.—*Short Service Commission*.—The appt. of Lt. J. B. Hardie (78389) is antedated to May 28, 1938, under the provs. of Art. 40, Royal Warrant for Pay and Promotion, but not to carry pay and allices. prior to Oct. 3, 1938.

Lt. J. B. Hardie (78389) to be Capt. Oct., 3, 1939, with seniority May 28, 1939. (Substituted for the notifn. in the *Gazette* of October 24, 1939.)

## QUEEN ALEXANDRA'S IMPERIAL MILITARY NURSING SERVICE.

### EXTRACTS FROM THE "LONDON GAZETTE."

May 21.—The undermentioned Sisters resign their appts. :—

Miss I. M. Treasure, Mar. 18, 1940.

Miss N. E. Lilly, May 21, 1940.

May 28.—The undermentioned Staff Nurses to be Sisters :—

Miss F. M. Bailey, Apr. 15, 1940, with seniority next below Miss F. V. Hynes.

Miss L. M. Carter, May 1, 1940.

Miss V. K. Holden, May 1, 1940.

Miss M. V. Howley, May 5, 1940.

The undermentioned Staff Nurses are confirmed in their appts. :—

Miss G. E. Thompson.

Miss L. M. Egan.

Miss J. K. Smith.

Miss E. I. Winter.

Miss J. M. Hill.

Miss M. P. Ransley.

Miss K. J. Ford.

Miss B. M. Speak.  
Miss Y. M. Douglas.  
Miss S. McDermott.  
Miss M. R. C. Wells.  
Miss F. M. Osborne.  
Miss E. M. Jenner.

*June 4.*—Sister Miss K. M. Lander retires, receiving a gratuity. *June 1, 1940.*

The undermentioned Sisters resign their appts. :—

Miss P. B. Read, *May 12, 1940.*

Miss M. M. Long, *June 1, 1940.*

Provl. Staff Nurse Miss J. Adams resigns her appt., *May 22, 1940.*

*June 7.*—Sister Miss Margaret Ellis resigns her appt., *Apr. 16, 1940.* (Substituted for the notifn. in the *Gazette* of *Apr. 19, 1940.*)

*June 11.*—Sister Miss F. M. Bailey resigns her appt., *May 26, 1940.*

The following Staff Nurses to be Sisters :—

*May 1, 1940* :—

Miss J. N. R. Murray, with seniority next below Miss L. M. Carter.

Miss B. N. Hughes.

*May 22, 1940* :—

Miss S. W. Kirkley.

Miss I. K. Buck.

The undermentioned Provl. Staff Nurses are confirmed in their appts. :—

Miss H. M. Deane.

Miss J. F. McA. Brims.

Miss L. M. Parish.

Miss M. G. Harrison.

Miss G. I. Sumpter.

Miss L. C. Allan.

Miss M. D. Etches.

Miss M. E. McEwan.

Miss S. E. Toland.

Miss J. Tozer.

Provl. Staff Nurse Miss V. M. Price resigns her appt., *Feb. 12, 1940.*

*June 14.*—The name of Staff Nurse Miss S. W. Kirkby is as now stated and not as in the *Gazette* of *June 11, 1940.*

## IMMEDIATE AWARDS BY THE C-IN-C., B.E.F.

### MILITARY CROSS.

Lord, Lieut. John Graham, R.A.M.C.

On *May 29*, when one of our anti-tank guns was in action near his aid post engaging advancing enemy tanks, Lieutenant Lord displayed courage and devotion to duty of a very high order. In the ensuing action while fighting at very close range the anti-tank gun was gradually overcome by superior numbers and all the gun crew hit. Lieutenant Lord attended to each casualty at the gun position as it occurred, under heavy fire, treated them at his aid post, and eventually got the wounded away in his truck under heavy machine-gun fire.

Reynolds, J., Lieut. (Acting Capt.), R.A.M.C.

Throughout the whole operations Captain Reynolds's example of coolness and self-control under fire was a great asset to his battalion. On the night of *June 1-2* the enemy shelled the Mole at Dunkirk, on which were concentrations of British and French

troops. Captain Reynolds obtained carrying parties to move the wounded, first to the beach and later to the ambulance. He altogether dealt with some two dozen wounded and accompanied them to the advance dressing station, where he worked all through the day. By his prompt action he saved many lives and showed a complete disregard for his personal safety.

### MILITARY MEDAL.

Roberts, No. 7519188, Cpl. G. T., R.A.M.C.

On *May 15* Cpl. Roberts was ordered to post stretcher squads at three R.A.P.s. Under continuous heavy shellfire he located the R.A.P.s and posted the squads. He remained at one R.A.P. until the post was destroyed by shellfire. He then conducted a squad back to the car post, where he collected some lost vehicles and conducted them to their destination in the dark. Throughout these operations he displayed exemplary courage, coolness, and initiative.

## R.A.M.C. ASSOCIATION.

The fifteenth Annual General Meeting of the Corps Association was held at the Royal Army Medical College, Millbank, S.W.1, on *Saturday, May 25, 1940.* The chair was taken by Lt.-Gen. Sir Harold B. Fawcus, K.C.B., C.M.G., D.S.O., D.C.L., Representative Colonel Commandant. The attendance was poor, due, no doubt, to the situation. The minutes of the Annual General Meeting held on *May 27, 1939*, were read and confirmed. The Annual Report of the Central Committee and the audited accounts for the year *1939* were unanimously adopted. It was decided to appoint the Regimental Serjeant-Major of No. 1 Depot and Training Establishment and the Serjeant-Major at the Royal Army Medical College to the

Central Committee, it being impracticable in the present circumstances to appoint members by name owing to the frequent movement of personnel.

Messrs. Evans Peirson and Co., Chartered Accountants, were re-appointed Auditors for the year 1940.

In reply to questions by the representative of the Crookham Branch the Secretary explained that the Chairman of the Central Committee had communicated with G.O.C.'s R.A.M.C. in the Home Commands with regard to the formation of modified committees at the headquarters of companies to function during the war, and that steps in this connexion are now being taken by companies. Attention was also drawn to the importance of the development of the Association's employment activities. It was explained that, at present, owing to the paucity of men available, it is often difficult to fill the vacancies offered, and that for this reason the Press advertisements of the Association have been discontinued for the time being, the cost of same being unjustified. As men become available, which it is anticipated they soon will, an employment campaign will be started.

The Central Committee wish particularly to draw the attention of branches to the importance of rendering Corps Association Employment Registration Forms to the Central Office for Men on discharge from the service in accordance with Rule 16.

In addition to the overseas branches, which continue to function as usual, the Crookham Branch, at which excellent work is being carried out, modified committees have been formed at Nos. 1 and 2 Companies, Aldershot; No. 4 Company, Netley; No. 7 Company, Catterick; No. 8 Company, York; No. 9 Company, Colchester; No. 18 Company, Millbank; and No. 19 Company, Warrington.

---

## DEATH.

RUSSELL.—At Instow, North Devon, on May 19, 1940, Major George Blakely Russell. Born on July 3, 1860, he was educated at Trinity College, Dublin, where he was Surgical Travelling Prizeman in 1882, and took the M.B. the same year. Commissioned Surgeon on August 2, 1884, he was promoted Surgeon Major August 2, 1896, and retired as Major on August 3, 1904. He was re-employed from August 3, 1914, till December 20, 1917, when he was relegated to unemployment on account of ill-health. He was Deputy Commissioner of Medical Services,

Ministry of Pensions, Portsmouth, from 1918 till 1927. Major Russell served in the Sudan in 1885, being brought to notice and awarded the Medal with Clasp and Bronze Star; in Burma in 1891-1892 with the Irrawady and North Eastern Columns, receiving the Medal with Clasp; and in France and Belgium in 1915, when he was brought to notice for valuable services rendered — W.O. Communique September 18, 1917 — and received the 1914-15 Star, British War and Victory Medals.

## EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

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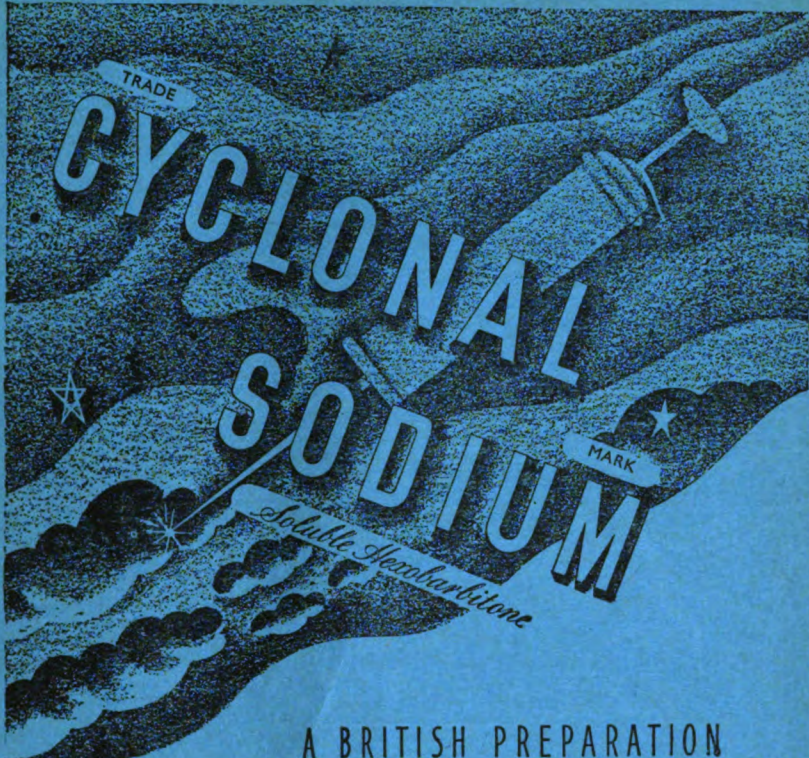
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## CONTENTS

ORIGINAL COMMUNICATIONS.	PAGE	CLINICAL AND OTHER NOTES.	PAGE
An Analysis of Knee-joint Operations. By Colonel N. CANTLIE, <i>M.C., F.R.C.S.</i> . . . . .	69	Gas Cleansing Centres, First-Aid Posts, and their Counterpart in the Field. By Captain W. A. ROBINSON, <i>R.A.M.C.</i>	114
Dermatology in War-time. By Colonel JOHN T. INGRAM . . . . .	78	A Note on the Treatment of Minor Sepsis. By Major D. P. LAMBERT, <i>I.M.S.</i> . . . . .	117
The Indian Hospital Corps. By Lieutenant-Colonel J. F. BOURKE, <i>M.C., R.A.M.C.</i> . . . . .	84	Water Difficulties in England. By Major C. W. HEALEY, <i>M.C., T.D., R.A.M.C.</i>	119
Duties of a Quartermaster's Department in Peace. By Captain (Quartermaster) J. G. EVES, <i>M.B.E., R.A.M.C.</i> . . . .	94	A Case of Serum Sickness. By Captain P. N. BARDHAN, <i>I.M.S., M.R.C.P.</i> (Edin.), <i>D.P.H.(Eng.)</i> . . . . .	120
Military Hospitals—Choice of Site and Design. By Major P. N. WALKER- TAYLOR, <i>M.D., B.S., F.R.A.C.S.,</i> <i>R.A.M.C.</i> . . . . .	101	The "M" Box Table. By Colonel E. M. COWELL, <i>C.B., C.B.E., D.S.O.</i> . . . .	122
EDITORIAL.		A Case of Pneumonia with an Eosino- philia Developing after M and B 693. By Major E. MASON BARKER, <i>R.A.M.C.</i>	123
The Mystery of Alimentation . . . . .	108	CURRENT LITERATURE . . . . .	125
		REVIEWS . . . . .	133
		NOTICES . . . . .	138

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AN ANALYSIS OF KNEE-JOINT OPERATIONS.

BY COLONEL N. CANTLIE, M.C., F.R.C.S.,  
*Royal Army Medical Corps.*

THE increase of sport and athletics in the Army has brought in its train so many injuries to the knee-joint that the subject is one of considerable importance. The object of this article is to analyse the results of knee-joint operations for the excision of fractured semilunar cartilages and allied conditions which I have performed in the last few years, and to discuss any causes of failure.

The total number of operations upon the knee-joint throughout the Army at home and abroad for a given period I have been unable to obtain, but Morris reports 203 cases operated upon in the Army at home for the year 1934. If one adds to this number the operations performed abroad one might give 300 cases as a conservative estimate. From information available it appears that the number of cases invalided from the Army as a result of knee-joint injuries has lately averaged 55 cases a year. It is, I think, reasonable to assume that practically all these cases had undergone operation. This would mean that roughly one in every six cases operated upon comes to invaliding later. In this connexion it must be remembered that the knee injuries the soldier receives are usually incurred "on duty," i.e. either on strictly military duties or during organized games which are included in the category "on duty." In such instances he is entitled to receive compensation.

It will be seen, therefore, that the activities of sport exact a not inconsiderable toll upon the Army—a toll assessed at the rate of one soldier per week from knee disabilities alone.

The cost to the State has also to be borne in mind ; not only the cost of training and feeding the soldier, but the cost of a disability pension afterwards. If this means that 55 men yearly receive disability pensions for long periods or for life, then the subject reaches great importance. I am not, however, prepared to make this statement. The exact significance can only be discovered by the study of statistics to which I have no access.

This paper is based upon the after-results of over 80 operations upon the knee-joint ; a small number, but sufficient to lead one to certain conclusions. The after-results have been judged on the condition existing at least six months after operation.

Before describing the results of operations, certain aspects of cartilage trouble require consideration :—

### THE MECHANISM OF KNEE-JOINT INJURIES.

Bristow describes three varieties of knee strain :—

(a) *Lateral Strain*.—Causing a tear of the ligaments of the inner or outer side of the knee.

(b) *Rotation Strain*.—Causing injury to the semilunar cartilages ; and usually combined with some degree of lateral strain.

(c) *Hyperextension Strain*.—Causing a tear of the crucial ligaments.

Let us translate these strains into injuries of the semilunar cartilages and neighbouring structures.

#### (1) *The Internal Semilunar Cartilage.*

This cartilage is injured by the combination of a lateral strain and a rotation strain. The lateral strain in this case is an abduction strain which forces the lower leg outwards at the knee-joint, thus tearing the internal lateral and coronary ligaments, and opening up the inner side of the knee-joint. The rotation strain in this case is an internal rotation of the condyles of the femur on the head of the tibia which is fixed through the foot to the ground. This rotation strain is not always essential before a semilunar cartilage is injured ; certain fractures of the cartilage can be caused by the effects of abduction strain alone. The tearing of the ligaments on the inner side of the joint to which the internal semilunar cartilage is anchored allows the joint space to open and the cartilage to pass inwards towards the centre of the joint between the internal condyle of the femur and the head of the tibia. When the force of the injury is expended, the bones resume their normal positions, and the semilunar cartilage is trapped between the internal condyle of the femur and the head of the tibia and is injured. The fracture affects the anterior, middle, or posterior portion of the semilunar cartilage according to the position of the knee at the time of the accident, and the force and direction of the damaging factors.

### (2) *The External Semilunar Cartilage.*

Injury to this cartilage is caused by the combination of a lateral strain and a rotation strain. The lateral strain is an adduction strain which drives the lower leg inwards at the knee-joint, damaging the external lateral and coronary ligaments, while the rotation strain is an external rotation of the condyles of the femur on the head of the tibia, the foot being fixed. The semilunar cartilage becomes trapped between the outer femoral condyle and the head of the tibia and is fractured.

In both internal and external cartilage injuries there are degrees of damage depending, as stated before, on the force and direction of the causative factors. It is possible, therefore, to imagine a state of affairs where the force is insufficient to cause a fracture of the cartilage after the tearing of the lateral ligaments. The semilunar cartilage will, however, have been wrenched from its lateral attachments, and though in correct position, it will be loose as it lies on the head of the tibia. This, in fact, is the condition occasionally found on opening the knee-joint. It is in such cases that rest and immobilization after a primary injury may lead to recovery. The lateral attachments of the cartilage undergo repair, thus anchoring it once more in place.

### (3) *Crucial Ligaments.*

The anterior and posterior crucial ligaments are tight in full extension of the knee-joint. A hyperextension strain will, therefore, if forceful enough, rupture one or both crucial ligaments, thus allowing hyperextension to occur with an accompanying lack of stability.

### (4) *Osteochondritis.*

The question of the mechanism of knee-joint injuries cannot be dismissed without discussing osteochondritis of the joint. By this is implied damage to the articular cartilage which covers the femoral condyles or the head of the tibia. This damage is generally the result of direct injury. A kick at football received full on the femoral condyle when the knee is bent is sufficient to damage or split the articular cartilage of the condyle. A case due to indirect injury which came under my care was caused by jumping. The patient, while fishing, jumped down several feet from one rock to another. The knee gave way with great pain, and an operation later showed an extensive split in the articular cartilage of a femoral condyle with many small pieces of cartilage loose in the joint.

In my series of 83 cases there were five cases of osteochondritis, and this condition should always be looked for on opening a knee-joint, especially when no obvious fracture of the semilunar cartilage is visible.

### (5) *Loose Bodies.*

To complete this short survey of knee injuries, "loose bodies" must be mentioned. Loose bodies may consist of : (a) *Synovial membrane* : Portions

of synovial membrane, chiefly fringes, torn off by injury. (b) *Semilunar cartilage* : When a fracture occurs a piece of cartilage may be completely detached. (c) *Articular cartilage* : This loose body is a detached portion of articular cartilage ; usually from a femoral condyle. (d) *Bone* : When a piece of articular cartilage is detached by injury it may take with it some bone cells. All cartilaginous and bony loose bodies gradually increase in size by proliferation.

#### (6) *Fractures Involving the Semilunar Cartilage.*

Bristow gives the following figures for fractures involving the semilunar cartilages :—

(a) Complete longitudinal fractures, 48 per cent. This is the so-called bucket-handle fracture where the fractured portion often lies between the condyles of the femur. In many instances this is really a fracture dislocation of the cartilage.

(b) Fracture of the anterior portion of the cartilage, 21 per cent.

(c) Fracture of posterior portion of the cartilage, 31 per cent.

#### *Diagnosis.*

The common symptoms of fracture of a semilunar cartilage are pain, locking and synovitis, following a sudden injury to the knee. When a typical case occurs the diagnosis presents no difficulty, but at other times one has to consider carefully every sign and symptom before making a decision. These are a few remarks on special points in the diagnosis :—

(1) A careful and accurate history is of the greatest importance. We have to base our diagnosis on what the patient tells us of the injury, and special care must be taken to put leading questions as to pain, locking, synovitis, etc.

(2) Locking. The knee becomes locked when a portion of a fractured and displaced semilunar cartilage becomes wedged between the bones, and in this position prevents full extension of the knee. Flexion is often free. The knee may also become locked by a cartilaginous loose body being caught between the bones. In this case the disability is usually a long-standing one, and the patient is often aware of the fact and can sometimes manipulate the body into a palpable position.

(3) Synovitis. In recent cases of injury synovitis is always present, but the more chronic the case the less the degree of synovitis likely to occur. This is because the joint fails to react to a condition to which it has grown accustomed.

(4) It may be necessary in certain cases to make a diagnosis without locking or synovitis. The following points often help :—

(a) Tenderness. Careful palpation along the joint line will often detect a painful spot. A fracture of the posterior portion of the cartilage may often be located by this sign. Palpation of the posterior joint line

should never be omitted, as it is the fracture of this portion of the cartilage which is the most difficult to detect, and constitutes the greatest problem in knee-joint surgery.

(b) Lateral mobility of the joint. Lateral mobility is the result of chronic and recurrent synovitis which stretches the capsule of the knee-joint and with it the ligaments which maintain its stability. This lateral mobility is highly significant of a semilunar cartilage injury.

(c) Wasting of the quadriceps. A tape measure should be used in every case of knee-joint injury. Wasting is rarely absent following a semilunar cartilage injury, especially with recurrent attacks.

(d) Manipulation of the knee-joints. This is done as follows: Grasp the foot with one hand and the knee with the other. Rotate the foot *outwards* and bend the knee. *Abduct* the leg as strongly as possible at the knee-joint and slowly extend the leg until the knee-joint is straight. The opposite movement should then be done. Grasp the knee and foot as before; rotate the foot *inwards* and bend the knee. *Adduct* the lower leg and slowly extend. These manipulations will sometimes reveal grating or crunching in the joint, thus demonstrating a fracture not discoverable by other means.

(e) Pain at the back of the joint is sometimes complained of on straightening the knee at the time of injury. This is due to the stretching of tendons behind the knee, caused by a displaced semilunar cartilage jamming between the bones.

(f) Finally, X-ray should never be omitted.

Some of these points in diagnosis can best be illustrated by examples:—

(1) Serjeant S., while bayonet fighting, suddenly twisted to the left, with the right foot fixed on the ground. He experienced severe pain on the inner side of the right knee, heard a crack, and found that his knee was locked and he could not extend it. He could not put his heel to the ground but hopped off on his toe. On examination twenty-four hours later in hospital there was no synovitis, but the knee was locked and there was a point of tenderness over the anterior end of the internal semilunar cartilage. The usual hollow to the inner side of the patella ligament was absent. Operation a few days later revealed a bucket-handle fracture (or fracture dislocation) of the internal semilunar cartilage, the whole of which was lying between the femoral condyles.

This illustrates the acute case, where diagnosis was obvious and immediate operation was undertaken, resulting in complete cure.

(2) Gunner G., while doing the long jump fell awkwardly and rolled over on his left side. He states he remembers no pain in the left knee at the time, and noticed nothing until his knee swelled up two days later, when pain and tenderness were present over the inner side of the joint. Operation revealed a bucket-handle fracture of the left internal semilunar cartilage.

This case illustrates the mildness of the symptoms which accompanied a severe injury. Both cases show that immediate operation is justified in recent primary injuries, a procedure which is not always advocated.



(3) Pte. C. Football injury in 1932. Diagnosed then as a sprain of the external lateral ligament of the knee. He was invalided out of the Army in 1934 as he was unable to do duty. His symptoms since then have been slight. He has an aching pain over the outer side of the leg, which sometimes causes him to walk with a limp. No synovitis or locking ever occurs. He came to have the joint explored owing to the length of the symptoms. At operation a fracture of the inner border of the external semilunar cartilage was found.

This case is an example of the chronic knee condition where severe symptoms may never be complained of, and one might hesitate to operate in the absence of more conclusive evidence.

#### *Operative Procedure.*

No originality is claimed for any of the following operative procedures. After a certain amount of experience, however, I have been impressed with the necessity of carrying out knee-joint operations according to a plan. Unless a plan is adopted it is possible to overlook the cause of the disability and fail in the operation. It is to indicate the steps and to help those who may have more limited experience that the following notes are given.

*Preparation.*—As for all bone operations, three preparations of the leg with iodine, commencing two days before the operation.

*Technique.*—A tourniquet is used and both legs hang at right angles over the end of the operating table.

The surgeon sits on a stool covered with a sterile sheet and facing the knee. The theatre should be capable of being quickly darkened.

For the internal semilunar cartilage, an oblique incision is used, crossing the joint line but avoiding, as far as possible, the patella branch of the internal saphenous nerve. A fresh knife is employed to open the aponeurosis and the synovial membrane, after tetra towels have been clipped to the skin edges. On opening the joint, a fractured cartilage may be visible, and the operation completed by its removal.

If a fracture of the semilunar is not visible the following steps are taken in succession :—

(i) The lower leg is grasped below the knee, and the leg twisted and pulled downwards to open up the joint space and see as much of the semilunar as possible.

(ii) If this reveals nothing, the knee-joint is bent up and the femoral condyle in the operation field examined for any sign of osteochondritis.

(iii) If nothing is found, a spot-light is directed into the joint and, if necessary, the theatre darkened. This will reveal the intercondyloid notch and the anterior crucial ligament. In addition, if there is a bucket-handle fracture of the opposite semilunar cartilage, it will be at once visible. I have been able in this way to reveal a fracture which, without a spotlight, would never have been seen.

(iv) If the light reveals nothing, the next step adopted is to place a hand over the popliteal area behind the knee. By pressing on the joint behind and by manipulating the knee with the other hand, I try to extrude any loose body.

(v) If this manœuvre fails, the joint is syringed out with sterile water to displace any loose body.

Assuming that these steps have shown nothing wrong, we know that we have eliminated: (1) Any visible fracture of the internal semilunar cartilage; (2) osteochondritis of the internal condyle of the femur; (3) injury to the anterior crucial ligament; (4) a bucket-handle fracture of the external semilunar cartilage; and (5) a loose body. The conditions left are: (1) A fracture of the posterior portion of the internal semilunar cartilage; (2) a fracture other than bucket-handle of the semilunar; or (3) osteochondritis of the external condyle.

A decision must now be taken on what is to be done. There are three alternatives:—

(i) Close the knee-joint and complete the operation.

(ii) Remove the internal semilunar cartilage *in toto* with the expectation that there is a fracture of the posterior third.

(iii) Expose the external semilunar cartilage to see if it is fractured, or if osteochondritis of the external condyle is present.

It is now that the importance of a careful and detailed written history comes in. This is our surest guide to the next step.

If we are sure from the history that a fracture of the internal semilunar cartilage exists then we adopt alternative (ii). Bristow's statistics show there is a fracture of the posterior portion in 31 per cent of cases.

If the diagnosis is not certain we may adopt alternative (iii) first, and if nothing abnormal is found, then we carry out (ii).

The temptation to remove the visible half of an internal semilunar cartilage on the chance of success must be firmly resisted. It is easy to imagine that the semilunar is slightly loose when a hook is put under it. There is of course a genuine disability due to a loosened internal semilunar cartilage (where the force causing the injury has stopped short of causing a fracture), but there must be no doubt of the fact that the cartilage *is* loose.

*Removal of the Semilunar Cartilage.*—I now remove the cartilage *in toto* and not only the fractured portion. I have adopted this procedure after failing at times to cure the condition by partial removal.

Pte. H., while playing football, twisted round while running and experienced severe pain in the left knee, fell to the ground, and the knee became locked. In August, 1931, he had an operation, when the anterior portion of the cartilage was removed. This did not cure him and he had recurrence of symptoms. In April, 1932, I removed the posterior part of the semilunar cartilage and he has been able to play all games since.

To remove the whole cartilage, anterior and posterior incisions are necessary, except in the case of bucket-handle fractures, when one can remove almost the whole cartilage by the anterior incision alone.

The technique adopted for removal of the internal semilunar cartilage is as follows :—

The anterior extremity of the semilunar cartilage is grasped by a pair of Kocher's forceps, and is separated with a knife as far back as possible, making sure that the internal lateral ligament is retracted and not damaged.

The knee, which has been bent at right angles over the end of the operating table, is then raised on the leg rest to a horizontal position, the knee flexed slightly and turned outwards. This exposes the inner and back portion of the knee-joint. An incision is now made over the postero-internal aspect of the internal condyle of the femur and the head of the tibia, 3 inches in length and crossing the joint line. This incision is made from above downwards and slightly forwards, approximating to the line of the internal saphenous vein, and if possible just in front of it. If the vein is divided the ends should be ligatured. Tetra towels are clipped to the skin edges, and the muscular aponeurosis and synovial membrane divided by a fresh knife. The object should be to obtain a view into the pouch at the *back* of the knee-joint. This will give an excellent view of the back of the semilunar cartilage. The Kocher's forceps from the anterior incision with the anterior portion of the cartilage still in its grasp is now pushed gently backwards, avoiding injury to the internal lateral ligament, until the anterior extremity of the semilunar cartilage appears at the posterior incision. It is then grasped by another pair of Kocher's forceps introduced through the posterior incision, and the first pair of Kocher's forceps are removed. By traction and cutting the semilunar cartilage can now be removed complete, under direct incision.

The joint is now syringed out with sterile water from both the anterior and posterior incisions to remove any debris which may have been left behind. The incisions are closed in two layers by suturing the synovial membrane and aponeurosis separately. Occasionally the posterior incision must be closed with one layer of sutures taking up both synovial membrane and aponeurosis together. All knots are tied with forceps and the catgut untouched by hand. The knee, it is to be noted, is still in a horizontal position and not hanging at right angles as at the commencement. This makes suturing much simpler. I use small half-circle fistula needles, and No. 1 plain catgut.

After painting with iodine a gauze roll is bound tightly round the joint ; then a large roll of cotton-wool ; and a flannel bandage applied firmly from mid-calf to mid-thigh. The tourniquet is then released. No splint is applied. The gauze roll is usually cut in bed under sterile precautions twenty-four hours later, after releasing the bandage.

I have tried the method of exposing the inner side of the knee-joint by a horse-shoe flap of skin as described by Timbrell-Fisher, and Pannett. I have abandoned it, however, for the procedure described above. The horse-shoe flap cuts across nerves and vessels. It is a large skin wound to stitch up, and I have found there is a tendency to slough at the edges.

The operation for excision of the external semilunar cartilage follows

similar lines. To make the posterior incision in this case, it is better to keep well back to avoid the tendon of the popliteus muscle. This muscle arises from the external condyle of the femur and runs downwards and slightly backwards to be inserted into the posterior aspect of the tibia. I have divided it when making the posterior incision too far forward, and its position should always be kept in mind. One can appreciate when it has been cut by feeling that a material support of the joint has been divided, and the tibia at once falls slightly away from the femur. It should be sutured at once.

When a bucket-handle fracture exists, division of the anterior and posterior attachments is usually all that is required. The posterior attachment is best divided by a special knee-joint knife which is introduced into the intercondyloid notch under a good light. It is important to carry out all divisions of the cartilage under direct vision as far as possible, as one can easily cut off slivers of articular cartilage from the surface of the tibia and femur unless care is exercised, and these slivers, if left behind, will in time grow and form loose bodies. The use of the special knee-joint knife will help to avoid such accidents. To remove any minute particles of cartilage which may be left in the knee-joint, I always syringe out with sterile water.

*Post-operation Care.*—From the third day the patient is encouraged to exercise the quadriceps by lifting the leg off the bed, or contracting the muscle. The stitches are removed on the eighth day, and two days later the patient is allowed up, with a short back splint behind the knee to give support, and with a crooked heel. The back splint is only retained for a day or two. Subsequent exercises to the quadriceps are given by sandbags over the instep, by faradism, and later by bicycle exercises.

*(To be continued.)*

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DERMATOLOGY IN WAR-TIME.<sup>1</sup>

BY COLONEL JOHN T. INGRAM,

*Late Consulting Dermatologist to the B.E.F.*

I PROPOSE first to describe the work encompassed by dermatology in the Army and then to discuss the way in which this work is being undertaken and organized. I shall endeavour to indicate to you some important general considerations and principles which underlie dermatological work and should guide its practice, especially under war conditions.

A digression here and there, to illustrate general principles by elaborating certain details may, I hope, be of some practical value and may allow me to say a word upon modern tendencies in treatment.

Dermatology is still regarded by many as something beyond the pale, at best a relic of the magic medicine of days gone by. It is often forgotten that ills of the skin are exactly comparable with those of other organs and that they can be studied more reasonably and simply than those ills that are hidden from view. Indeed, it is a little presumptuous, a little ridiculous, to deceive oneself into believing that one has an understanding of evil working in the depths if one is ignorant of surface manifestations of the same pathological and physiological processes. The dermatologist is inevitably an honest and a modest man—he can neither deceive his patient nor himself. But for modesty I might have taken for the title of this talk, “How to Win the War—Dermatologically.” Let us consider a few facts.

You know that in the last war nearly half a million men had venereal disease. You will know how this may interfere with man-power and efficiency when I remind you that treatment and observation of a case of syphilis takes a minimum of two years, and gonorrhœa a minimum of four months. At the end of the war there were 9,000 beds in France devoted to the treatment of venereal disease alone, and over 20,000 throughout the Forces.

The Official History of the War records that in the summer of 1917 more than 90 per cent of all disability was the result of skin diseases or their complications. In the Balkans I believe that something approaching two-thirds of the medical and nursing staff of the Rumanians died of louse-borne typhus. It was the exception for our men not to be lousy, and apart from the danger of complications this means a considerable loss of efficiency.

It is, then, legitimate to link victory or defeat with dermatology, and I suspect that the issue in many wars has turned on such diseases.

Now on the credit side there are at least three important virtues attached to the study of dermatology. First it keeps in training our powers of

<sup>1</sup> Read before the British Medical Society, Dieppe Sub-area, B.E.F., April 3, 1940. The delay in the publication of this article is much regretted.

observation. Secondly we have demonstrated the essential principles which underlie the practice of medicine. Thirdly we cannot evade the necessity for exercising common sense. You will perhaps agree that all these virtues have tended to be submerged in recent decades by waves of medical fashions and fads and even by scientific progress.

#### ORGANIZATION.

Dermatology in the Army embraces the following ills:—

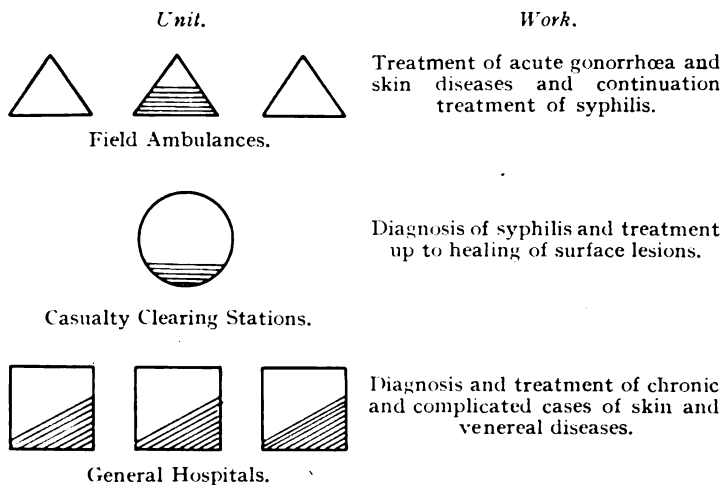
*Venereal Diseases.*—Syphilis, gonorrhœa, chancroid and other venereal diseases.

*Parasitic Affections.*—Scabies, pediculosis, and Phthirius infestations.

*Skin Diseases.*—Pathological, physiological.

In the last war all these diseases were dealt with in central skin and venereal hospitals established for the purpose. The results were good, but there were certain disadvantages, e.g. (1) a wastage of man-power was inevitable, a wastage which would be enormous to-day because of the more prolonged treatment which is recognized as being necessary; (2) men sent to these hospitals were soon known, at home and abroad, to be suffering from venereal disease; (3) the work at these central hospitals and the personnel were largely divorced from the spheres where the ills arose and from the rest of the medical work of the Forces.

In this war an effort has been made to avoid those disadvantages. The organization which is now taking shape may be illustrated by the following diagram.



One field ambulance in each division is dealing with the venereal and skin diseases of that division as far as possible. A minimum of necessary equipment, including a microscope, is provided. The work is in the charge of an officer interested in venereal and skin diseases who has volunteered for the work and has attended a course of instruction at the base.

The object of the course of instruction is to review the essentials in diagnosis and treatment of the more common skin and venereal diseases and to establish some uniformity in treatment. It also affords an opportunity of ensuring a knowledge of the Army Forms relating particularly to cases of venereal disease so that proper records and proper disposal and observation of cases are achieved. A further purpose of this course is to establish contact among the officers and between the officers and those of us who are organizing and directing this work—Lieutenant-Colonel J. M. Elliott, R.A.M.C., and myself. It enables us to work as one team pooling our knowledge and our resources and our purpose.

It would be ideal for each field ambulance to function in this way, but it is felt that the burden of equipment and the expense do not allow this for the present, though it is possible that a mobile unit of equipment might be employed to overcome these difficulties. In the field ambulance, all cases of acute gonorrhœa—first attacks—are given treatment along simple, modern lines, with M & B 693. Chronic cases and complications are sent to the medical base.

Cases of syphilis are diagnosed at the casualty clearing station and are retained for treatment until all surface lesions have healed and at least two injections of arsenic and bismuth have been given. After that, further treatment is continued at the field ambulance.

Cases of skin diseases which can be cured in seven to fourteen days—such as impetigo, scabies, mild cases of dermatitis, pityriasis, etc.—are treated at these field ambulances.

At most of the general hospitals at the medical bases there will be established separately a number of wings for the treatment of skin and venereal diseases, each under a specialist and equipped to undertake treatment of the complicated and more chronic cases which will be returned to general hospitals. These V.D. wings and dermatological wings will be part of the hutted hospitals and will each accommodate about 100 patients.

Such a scheme is intended for the type of static warfare which we are experiencing at present. If battle casualties arise all active cases of venereal and skin disease will be evacuated to the medical bases and will be centred round those V.D. and skin wings already functioning. Combined skin and V.D. wings under a specialist are being established at general hospitals along lines of communication and these might also be used to deal with cases evacuated from forward areas in times of battle stress. For the present the scheme avoids the difficulties associated with centralization and allows appropriate treatment to be started at the earliest stage of the disease.

#### TREATMENT.

*Venereal Diseases.*—The proper treatment of venereal disease is prevention, and in the Army the incidence of venereal disease should not be high.

To hide under a veil of secrecy all matters relating to sex must invite curiosity and encourage indecency and the risk of venereal infection. It is

wiser to allow some elementary instruction in physiology and biology as a part of education and under these circumstances to teach men the nature of venereal diseases, how they are contracted, and how they may be avoided. The Army must embrace a few whom we must describe as addicts and others, robust and adventurous youths, in whom the urge to sexual indulgence will be too strong for them to resist. Let us then deliberately provide some prophylactic measures with instructions as to their value and how they should be used. Considerable responsibility rests upon medical officers in these matters.

I must to-day not start an argument on the modern treatment of gonorrhœa with sulphapyridine (M & B 693) and sulphonamide, but I may perhaps express my belief that these drugs will never cure 100 per cent of cases and that dosage will tend to be small as compared with dosage for other diseases.

The course of treatment adopted at the moment is : Sulphapyridine (M & B 693)  $1\frac{1}{2}$  tablets at 7 a.m., 12 noon, 5 p.m., 10 p.m., for five days ; followed by sulphapyridine (M & B 693) 1 tablet at 7 a.m., 12 noon, 5 p.m., 10 p.m., for five days.

Irrigation may be employed at the discretion of the medical officer. Tests for cure—three tests at weekly intervals—are started five days after the cessation of treatment. Further tests for cure are conducted after an interval of three months.

The standard course of treatment for syphilis is the following :—

<i>Intravenous</i>			<i>gram.</i>	<i>Intramuscular</i>			<i>gram.</i>
Day 1.	Novostab..	..	0.45	Bismostab ..	..	0.3	
Day 5.	Novostab..	..	0.6	Bismostab ..	..	0.3	
Day 12.	Novostab..	..	0.6	Bismostab ..	..	0.3	
Day 19.	Novostab..	..	0.6	Bismostab ..	..	0.3	
Day 26.	Novostab..	..	0.6	Bismostab ..	..	0.3	
Day 33.	Novostab..	..	0.6	Bismostab ..	..	0.3	
Day 40.	Novostab..	..	0.6	Bismostab ..	..	0.3	
Day 47.	Novostab..	..	0.6	Bismostab ..	..	0.3	
Day 54.	Novostab..	..	0.6	Bismostab ..	..	0.3	
Day 61.	Novostab..	..	0.6	Bismostab ..	..	0.3	

In the first year of treatment four unit courses are given with the following intervals :—

Interval between Course 1 and Course 2, four weeks.

Interval between Course 2 and 3, five weeks.

Interval between Course 3 and Course 4, five weeks.

Cases of primary syphilis with a negative Kahn reaction receive the treatment indicated above. Cases of syphilis with a positive reaction receive three-unit courses after the blood reaction has become negative. A rest of three to six months is given after the first four unit courses have been completed.

*Parasitic Affections.*—The problem of parasites is as important as that of venereal disease because of the loss of efficiency involved, the secondary septic complications which are so common, and the seriousness of louse-borne disease such as typhus, trench fever, and relapsing fever. Our present



methods of treatment for scabies and for lousiness are good but, as with venereal disease, we should be able to prevent these diseases. In pediculosis, the ideal is to spray the clothes with something repellent to the louse and harmless to the skin and clothes. Considerable advances have been made recently, particularly by Professor Buxton, and research along the lines indicated holds out hopes for an early attainment of the ideal proposed.

Such methods would not, I think, solve the scabies problem completely, for this is more intimately a bed-contact affection. A word on the treatment of scabies might not be out of place as it stresses the importance of common sense. The *Sarcoptes scabiei* burrows under the skin and lays her eggs there. To cure scabies the *Sarcoptes scabiei* and eggs must be exposed, and to achieve this the overlying skin forming the roof of the burrow must first be macerated and then removed by scrubbing. This is achieved by rubbing all scabietic sites with soft soap for several minutes, then soaking in a hot bath for several minutes and finally scrubbing. It is not achieved by jumping into a hot bath with scrubbing brush and soap and having a casual scrub, neither is it achieved under a shower bath. Having exposed the parasites and eggs there are a hundred and one effective remedies, all of which are ineffective without the preliminaries. Not only so, but to achieve results the medical officer, the responsible orderly, and the patient must know something of the sites attacked and the habits of the *Sarcoptes* and so of the rationale of the treatment.

*Skin Diseases.*—It is consoling to find in dermatology confirmation of our faith in those fundamentals which at the start of our medical careers we believed all-important, but which we lost in the fog of scientific progress which was later heaped upon us.

Skin affections are either pathological entities or physiological reactions. Pathological diseases are real and substantial; they are almost invariably symptomless; they have or should have specific causes and are cured, or should be cured, by specific remedies. Physiological reactions, e.g. pruritus, eczema, urticaria, erythema, seborrhœic manifestations, psoriasis, etc., are the counterpart of those multitudinous ills in general medicine which, I believe, are being rediscovered under the title of Neo-Hippocratic or constitutional medicine. They are the reactions of a physiologically sensitive being to the various traumata, physiological, dietetic, climatic, environmental in the widest sense, to which he is exposed. Their permanent solution lies in the understanding of the individual (as opposed to disease) and the imparting of that understanding to the individual so that, after removing such offences as are removable, he may cure himself by adjustment and adaptation. A very different problem from the cure of disease. It will be appreciated that skin reactions differ one from another as much as individuals differ, and for the same reasons. Unless the underlying principles are grasped these minor differences make the study of dermatology appear difficult.

The local treatment of skin diseases has advanced considerably in recent

years largely along reasonable and intelligent lines. The value of rest has been recognized and of supporting and occlusive dressings which shut out external influences and put the affected part out of sight and out of mind.

It is interesting to note that this relatively tough organ is very intolerant of interference ; that dermatological ills are readily aggravated and provoked from trivial to grave dimensions often through treatment. Masterly inactivity will often score the highest marks. Lassar's paste, for example, a harmless remedy, applied to the most inflamed skins will assist the cure. Lassar's paste removed and re-applied three times daily instead of being left alone will generally aggravate a dermatosis. The ordinary antiseptics—which have a definite though small place in treatment—may readily cause trouble because of their irritant properties. In the aniline dyes which are non-irritant we now have measures which are of great value in the treatment of infected skins, in pyoderma, sycosis, and seborrhœic affections. It is absurd to apply to a skin which breathes, secretes, and excretes, and which when it comes to us, is often weeping pus or serum, an ointment which interferes with all these functions and which merely rides harmlessly upon an exudate. The appropriate application is a paste which, by reason of the powder it contains, overcomes these faults. The introduction of an emulsifying agent into an ointment base, a recent advance in skin therapy, also overcomes some of the disadvantages by effecting emulsification of the application with discharges or secretions.

There is a wealth of interest and instruction to be derived from dermatology ; it inculcates a sense of proportion and keeps you near to the simple truths and facts of life. When you recall that there are few of us who escape all dermatological troubles it is obviously unwise to neglect this branch of medicine.

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## THE INDIAN HOSPITAL CORPS.

BY LIEUTENANT-COLONEL J. F. BOURKE, M.C.,

*Royal Army Medical Corps.*

### I.—INTRODUCTORY.

IF the proverb that "Happy is the country which has no history" is applicable to lesser entities, the Indian Hospital Corps should indeed be regarded as fortunate, as not only has it no authentic recorded history, but the verbal traditions about its origins and developments are uncertain, partially untrue, and contradictory. The present writer found this to his cost when it fell to his lot to write the six-line succinct history note which now heads the Corps' entry in the Indian Army List.

To obtain the requisite knowledge for that miniature summary a lengthy correspondence had to be conducted and much of the written word perused.

### II.—ARMY HOSPITAL NATIVE CORPS, 1881.

In the early days in India the subordinate hospital personnel were raised on a local or temporary basis as considered most applicable according to the circumstances of the case, and there was no co-ordinated connexion between the various military hospitals in the matter of such minor personnel.

The station hospital system, following its introduction in the United Kingdom in substitution of the regimental hospitals in 1873 [1], was applied to India in 1881; to the Bengal Presidency troops in the first instance, the Bombay and Madras armies following suit at a later date [2]. As will be seen, it took the Indian authorities eight years to adopt the system, and when they did so they seem to have been influenced by the issue of new revisions in England, as the official entry occurs in 1881: "following the Regulations of the Medical Department of H.M. Army War Office Nov. 1878." The station hospitals were solely for British troops. Brief respite was only allowed before "Hospital Serjeants of Convalescent or other Depots and of Regiments of Cavalry and Infantry will be absorbed as soon as practicable."

"The allowances for Battery Hospital Serjeants and Acting Hospital Serjeants will be discontinued from 1st November 1881."

The Bengal Army extended over a very wide area from Calcutta in the east to Multan and Campbellpore in the north-west.

The new-type British hospitals were ordered to be established at stations, among others, with such familiar names as Benares, Allahabad, Fyzabad, Naini Tal, Ranikhet, Agra, Muttra, Delhi, Jullundur, Sialkot, Fort Attock, and Nowshera.

These newly formed hospitals had to have staffs of subordinates, and for

this purpose the Army Hospital Native Corps was formed under the authority of Clause 25 of Indian Army Circulars of January, 1881, and the original staffs were largely recruited from the personnel of the disbanding regimental hospitals.

The minor medical personnel of these hospitals consisted of "Compounders, Dressers, Barbers, Ward Coolies, Cooks, Shop Coolies, Bhisties and Sweepers." It was ordered that the new designation of these subordinates in general was to be "hospital attendants," and they were to be classified in detail as "ward servants, cooks, water carriers and sweepers."

It is worthy of note that the rules did not apply to "dhoolie bearers,

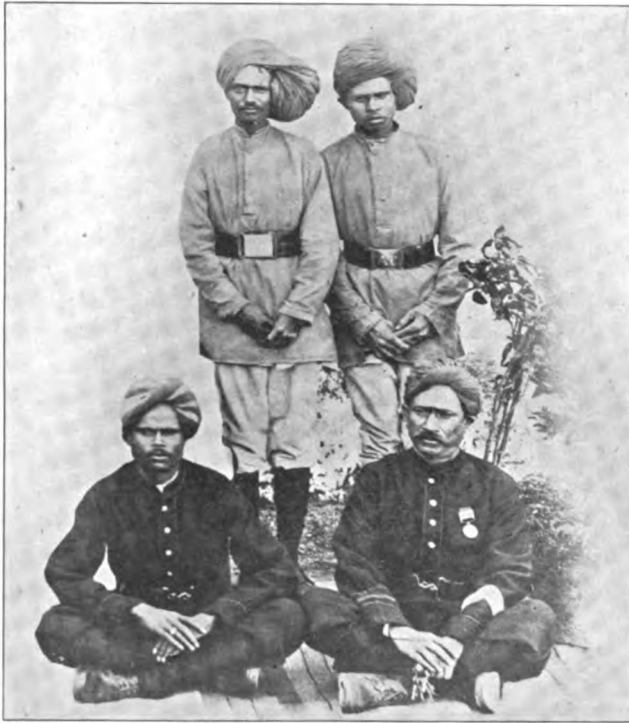


FIG. 1.—Army Hospital Corps men (in blue) with two dhoolie bearers (in khaki) of the Commissariat-Transport Department.

or purveyors, or their establishments, who will continue to serve under existing regulations."

Hospital writers, on a civilian basis, were allowed on a scale of "one for each station hospital or independent section thereof" [3].

It was decided that former head compounders, assistant compounders, and head dressers of the regimental establishments might join the new corps as first-grade ward servants, the others (shop coolies, barbers, and ward coolies) as second-grade ward servants.

The establishment for the Bengal Army commenced with 1,872 hospital attendants (891 ward servants, 259 cooks, 297 water carriers, and 425 sweepers).

The new corps had three gradings in each category of personnel. The original rates of pay were :—

Ward Servants and Cooks	...	...	Rs. 5/-, Rs. 7/-, Rs. 9/- a month
Water Carriers	...	...	Rs. 5/-, Rs. 6/-, Rs. 7/- a month
and Sweepers	...	...	Rs. 4/-, Rs. 5/-, Rs. 6/- a month

The senior sweeper in each hospital was granted a special allowance "for the custody and care of leeches" of Rs. 1/- a month. Quarters were provided for the hospital attendants, but free rations were only supplied when they were employed on foreign service or on board ship. The clothing provided for ward servants was of blue cloth, the long chapkan coat had scarlet piping on the sleeves and cuffs, with a blue and scarlet cotton puggri: "in addition to clothing provided by Government each ward servant will provide, as required, at his own expense a waistband (kamarband) to match the puggri."

No reason is given why the lowly paid third-grade ward servant should have to provide his own waist-band besides feeding himself and his family on his humble 5 rupees a month.

It is difficult to follow the order that "merzais or jackets" would be worn by water carriers and sweepers, as the word "merzai" is correctly applied to a type of shoddy cloth commonly called "militia cloth" and not to a particular kind of garment.

The hospital attendants had a "corps badge" which was to be worn over the left breast, namely "a solid brass disc 2½ inches in diameter, rough grained ground and raised burnished border." The disc was to be made slightly convex and to bear a "crown," the word "BENGAL," and the letters "A.H.N.C."

In fact it was practically the familiar "chaprass" or messengers' metal breast badge of present-day official and commercial usage. Grade distinctions were shown by two red cloth rings showing one blue cloth space between, for first grade, and one red ring for second grade personnel. These distinctions were to be worn three inches above the left cuff.

Good conduct badges, "as worn by the Native Army will be worn by men entitled to good conduct pay."

The Army Hospital Native Corps was not at first introduced into the Madras and Bombay Presidencies where the regimental hospitals still functioned "pending the introduction of the Station Hospital System."

The Presidency Armies were finally abolished from April 1, 1895, by a General Order of the Government of India, and the same system of administration was enforced for all India [4].

Now that a detailed outline of the origin and composition of the Corps has been recorded it is not proposed to follow intimately all its vicissitudes. It must, however, be noted that the word "native" was dropped between

1888 and 1891, as it had become a slighting and repugnant word, as used in India, to the inhabitants.

No trace can be found of the word being specifically withdrawn from the title of the Corps, and it appears to have disappeared either by common consent or possibly by a general order issued between the years indicated above.

### III.—ARMY BEARER CORPS, 1901.

From time immemorial the traditional means of the carriage of the wealthier classes in India had been by means of palanquins, variously called the "dhoolie" and the "dandy" borne by human carriers. [The word for "dhoolie" should, strictly speaking, be transliterated into English as "doli"; the other form was in common use in the days under review and will be continued in this paper.]

The dhoolie is still in use in hill stations and in the more remote country districts, and is ceremonially used to convey the gaily clad boy bridegroom to the festivities of his child marriage.

Before the making of the great connecting roads in India, apart from water transport, the dhoolie was the universal method of conveyance by those who could afford to use it, and the cost was by no means small. In the thirties of the last century it was estimated to cost a rupee a mile.

First of all a route (dak) had to be laid out by the advance agent (the chobdar), who arranged for additional bearers as well as proclaiming the merits of the sahib he served. "My Sahib is the Great Captain Esmitt, Sahib Bahadur, the hero of a hundred battles, who has killed uncounted numbers with his sword and at whose glance wild tigers and evil spirits slink away in terror. Take care, therefore, to behave in his Presence with great humility and circumspection," and so on.

The Sirdar Bearer, from whom the present personal servant "bearer" derives, besides taking charge of all the other bearers and superintending their work, ingratiated himself with his European master by always having the invariable "brandy-pawnee" to hand in as cold a state as possible. The number of bearers engaged varied with the length of the journey, the speed which urgency dictated, and the climatic and under-foot conditions.

Fixed halting places (paraos) were usually placed at roughly fifteen miles distance from one to another as a day's journey, with from six to sixteen bearers to allow for suitable changing over while travelling. Double paraos (thirty miles) could be accomplished if speed was vital by engaging local bearers.

As for all important occupations in India, a special caste developed or took over this work, the kahars, who excelled all others in carrying dhoolies, and who, being high-grade Hindus, could give water to men of any caste.

Thus the Army found when it started its adventures in India an excellent established palanquin system, operated by reliable and trained personnel.

The first dhoolie bearers the Army employed were either under regimental

control or operated by the Commissariat Department, later by the newly formed Transport Department, who made over its dhoolie bearers to the Military Medical Service in 1901 to help to form the Army Bearer Corps.

In earlier days Frontier Force battalions were allowed thirty-four kahar bearers with one "mate" (overseer), and other battalions were given six bearers in peace. It has been stated that the regimental medical officers in the Indian Service acted more or less as recruiting officers for these dhoolie bearers. From 1902 to 1906 the authorized establishment of the Army Bearer Corps was 6,000. In 1907 stretcher carriers were taken into use in place of the old heavy type of dhoolie and the active cadre of men was reduced to 1,500 [5].

In the Great War the number of dhoolie bearers had reached the formidable figure of 19,000 by 1917, which sufficed for the remainder of hostilities.

A glance may well be taken at the system in vogue for training dhoolie bearers prior to the Great War. The official pamphlet, from which extracts are given, was issued in 1911 and reprinted after the commencement of hostilities, so that its influence must have affected very large numbers of men in their training.

It will be seen that the object aimed at was to make the bearers primarily hardened carriers of their dandies and secondarily proficient in elementary drill, tent-pitching, and very simple first-aid (the use and application of the first field dressing).

Modern refinements such as map reading, St. John Ambulance Certificates, signalling, bugling, piping, band-playing, with a complex educational training which obliges every Sepoy Section recruit to pass a written examination in Roman Urdu were still in the womb of Time, along with anti-gas precautions.

"The training of the men of the Army Bearer Corps should consist of:—

- " (i) Company and stretcher drill.
- " (ii) Striking and pitching tents.
- " (iii) Conveyance of sick and wounded.
- " (iv) First-aid.

"The amount of training in company and stretcher drill should include what is necessary for ordinary movements of forming up, marching, and dispersing and for the correct handling, loading and carriage of wounded. It should be carried out by a system of parades, at headquarter stations under the D.A.D.M.S. (Mobilization) and at other stations by arrangements made by the O.C. Station Hospital and Senior I.M.S. Officer.

"Similarly the loading of dandies should be carefully practised. Training in the conveyance of sick and wounded will primarily aim at keeping the men of the Army Bearer Corps physically fit for their duties as dandy bearers especially by hardening their shoulders. For this purpose a graduated scheme of route marches will be submitted by the D.A.D.M.S. (mobilization) for the sanction of the divisional administrative medical officer annually.

“The scheme should include route marches with empty dandies over graduated distances of five to fifteen miles, to be succeeded by similar route marches with dandies, loaded with graduated weights of 10 to 140 pounds.

“The training of men of the Army Bearer Corps in first-aid will be simple and confined to a knowledge of the object and use of the first field dressing and the care required in the handling and carrying of various classes of wounds and injuries” [6].

#### IV.—INDIAN HOSPITAL CORPS, 1920.

Before the Great War the Army Hospital Corps existed solely to provide subordinate medical personnel for the hospitals for British troops. The Indian troops, when hospitalization was necessary in peace, were treated by their own Regimental Medical Officer, with the help of his Sub-assistant Surgeon, while sepoys from the unit gave such nursing ministrations as they could. To this nucleus staff the unit added the necessary menials—the sweeper, the water carrier, and the appropriate cook.

The regimental hospitals were non-dieted, and the patients lived on the same food as their comrades, unless it was supplemented or replaced, when specially ordered, by medical comforts.

Furniture, beds, linen, etc., were not provided by Government [7].

After the Great War it was decided that the Indian Army should adopt the Station Hospital system for all its Indian personnel, the follower class included.

It was also decided that new personnel for all station hospitals should be specially raised, and that the Army Hospital Corps and the Army Bearer Corps should cease to exist as separate entities and be fused to form the Indian Hospital Corps.

The Corps was organized on a divisional basis, and the company headquarters were situated at the divisional headquarters stations. The first allocation of the ten companies was as follows: No. 1 Peshawar, No. 2 Rawalpindi, No. 3 Lahore, No. 4 Quetta, No. 5 Mhow, No. 6 Poona, No. 7 Meerut, No. 8 Lucknow, No. 9 Secunderabad, and No. 10 Rangoon [8].

The companies were commanded by an officer of the R.A.M.C. or I.M.S. with an Assistant Surgeon of the I.M.D. in sub-charge. Two Indian officers, a Subadar and a Jemadar, were provided at Company Headquarters for the purpose of training, supervision, and the maintenance of discipline; these were at first selected Indian officers from the Infantry, who were gradually succeeded by those promoted from the ranks of the Corps.

Each company was formed of four sections of Indian other ranks, whose appellations denote their duties: Clerical, quartermaster, nursing (for Indian hospitals only), and ambulance (who replaced the Army Bearer Corps), with the ranks of havildars, naiks, and orderlies.

The General Section was formed to carry out the menial duties in all medical units and was subdivided into cooks (for British and also others for



Indian troops), ward servants (for British hospitals only), water carriers, washermen, barbers, and sweepers. The barbers were afterwards suppressed.

One schoolmaster and two physical training instructors were attached to the companies until they could provide their own.

The Indian other ranks were to be raised from suitable ward orderlies,

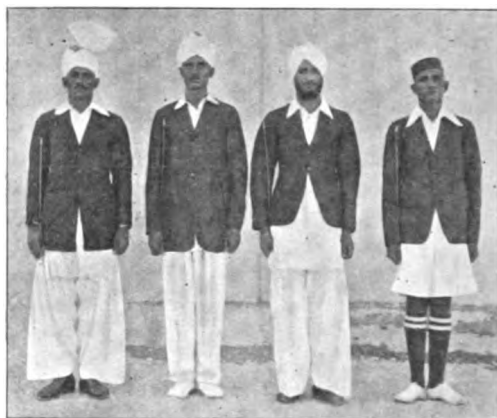


FIG. 2.—I.H.C. Sepoys in official mufti. (L. to R.) Mohammedan, Hindu, Sikh, Garhwali.

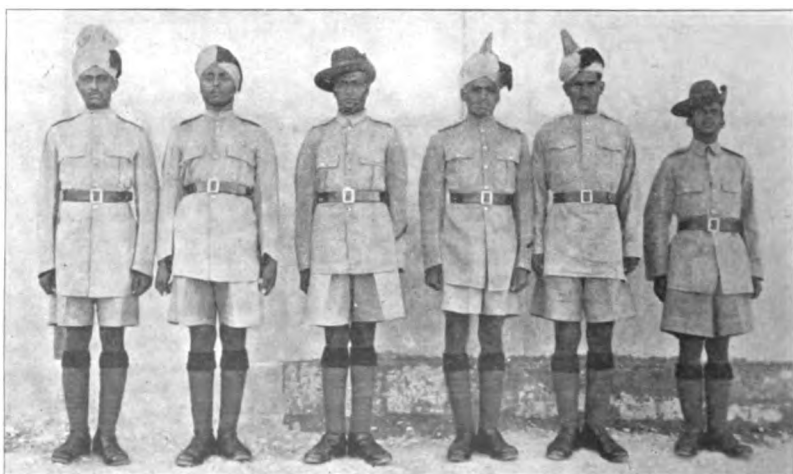


FIG. 3.—I.H.C. Types. (L. to R.) Mohammedan, Sikh, Garhwali, U.P. Hindu. Sepoys : Mohammedan ward servant, Gurkha water carrier.

of whom vast numbers had been employed in the Great War, and from A.B.C. and A.H.C. men.

To give some idea of the size of the new Indian Hospital Corps on its formation the authorized establishments are quoted : British officers 10. British Warrant Officers (Assistant Surgeons) 10, Indian officers 19, ambu-

lance section 4,400, clerical 284, nursing section 1,140, general section 5,524; grand total all ranks 11,996 [8].

The Corps had no provision for a reserve on its formation and this was remedied in 1925, when an Ambulance Section Reserve of 1,400 Indian other ranks was authorized [9].

These reservists did not come up for training annually, but were mustered biennially for medical and other inspections and to receive their reserve pay.

A Nursing Section Reserve of 1,800 was authorized in 1929 and the Ambulance Section was increased to 2,500 by direct enrolment of supplementary reservists for a period of ten years [10].

The whole Corps was reorganized on a Command basis in 1929 when all the companies except No. 4 (Quetta) and No. 10 (Rangoon) were amalgamated



FIG. 4.—Ambulance Sepoys in Field Service Order.

within their Commands as follows: The old No. 1, No. 2, and No. 3 Companies to form the new No. 1 Company for Northern Command with Headquarters at Rawalpindi. The old No. 7 and No. 8 Companies to form the new No. 2 Company at Lucknow for Eastern Command. The old No. 6 and No. 9 Companies to form No. 3 Company at Poona for Southern Command. No. 5 Company (Mhow) had ceased to exist [11].

Three new classes of Indian officers were authorized—a Jemadar clerk, a Jemadar quartermaster, and a Jemadar educational instructor: one of each of the last two-named classes was appointed to each of the companies. The Jemadar clerks were only appointed to the larger companies.

“In the Stores Section the prefix ‘Quartermaster’ is abolished, and all ranks, other than those in the General Section, will in future be designated Havildar, Naik or Sepoy”: thus died the terms Ambulance Orderly and the like [11].

A by-wash of the 1931 world economic crisis swept away 1,000 active Ambulance Section personnel and substituted 1,000 reservists, besides

affecting other reductions which it is not proposed to enumerate in detail here [12].

A very important step in co-ordinating the administration of the Corps was started in 1935, when an I.H.C. Record Office was formed at Kirkee. Formerly a large number of trivialities relating to individuals had to be referred to Army Headquarters, and decisions on such cases, not necessarily being communicated beyond the inquiring company, a similar case might be laboriously worked up and submitted for an Army Headquarter decision by another company. The new Record Office, besides abolishing such inco-ordination, acted as a convenient centre for the collection of information and documents and the distribution of instructions about the domestic side of the companies and their personnel, the control of higher Corps promotions, and as a co-ordinating centre between companies and Army Headquarters [13].

History was made in 1937 when a Company Commanders' Conference was held at New Delhi which was attended by a representative of the Adjutant General, and also one of the Medical Directorate, by the Officer in Charge of Records and the Company Commanders. Sanction has since been accorded for a similar conference biennially.

Agreement was reached on a number of points to secure uniformity in dress and other regimental matters, including a Corps crest and colours; these agreements were submitted as recommendations and were ultimately approved by Army Headquarters, when feasible.

The Conference formulated its views on a large number of points relating to matters of finance, promotion, allowances and the like, matters which engage the attention of every thoughtful soldier in every army in the world, and had the satisfaction of knowing that their opinions would be carefully and sympathetically considered.

In 1938, owing to the separation of Burma from India, No. 5 Company was abolished on the formation of the Burma Hospital Corps.

A difficult problem concerning the status of the Corps was defined, if not solved, by an Army Instruction (India) of 1928 with amendments in 1932 and 1933.

In India, for convenience in publishing orders, instructions and directions, a system in dealing with military personnel had arisen of classifying N.C.O.'s and sepoy's into "combatants," as a superior grade, and other personnel as "non-combatants," as an inferior grade.

The Corps Indian other ranks could be given the status of "combatants," but not the name, without losing the protection of the Geneva Convention when engaged in hostilities with a Power signatory thereto. The General Section men were enrolled, but not attested, and had the same status as Class I Regimental Followers, and were at all times subject to the Indian Army Act.

They were on a very different basis to the odds and ends of menials who accompanied units and were loosely enumerated as "Class II Followers."

Hardship arose when applications for superior advancement in other corps for which certain I.H.C. other ranks were eminently suitable, were restricted to N.C.O.'s and men of "combatant units," and also to all ranks of the I.H.C. when railway concessions were granted by the companies concerned to "combatants."

Gradually these disabilities are being remedied. The original definition of the status of the I.H.C., as amended, is as follows :—

"To remove all misapprehensions with regard to the status of the Indian Hospital Corps, it is hereby notified that personnel of that Corps, except the General Section, are of the same standing as soldiers of the combatant branches of the Service, and that the General Section is of the same standing as Class I regimental followers. The decision does not in itself involve the grant of any additional concessions to the Indian Hospital Corps.

"In future the personnel of the Indian Hospital Corps will be considered equally when any further concessions are proposed for Indian soldiers or Class I followers, provided that such concessions are applicable to their conditions of service" [14].

It is not proposed to consider in any detail the vexed question of the pay, allowances, and other amenities of the Corps, which is still the lowest paid in the Indian Army. Fifteen years ago comments were raised in the *JOURNAL OF THE ROYAL ARMY MEDICAL CORPS* that it was anomalous that personnel charged with the care of wounded and sick British and Indian troops should be paid less than mule drivers [5].

The practice still continues, although several individual concessions have been granted. The present policy is to strive to attain, as the next step, the pay and other advantages of the R.I.A.S.C. mule driver class for the Corps Indian other ranks, and to end the anomaly of the General Section men who are given a mosquito net, but no bed or poles on which to erect it, and rations, but no fuel with which to cook them.

For generous help in blazing a trail in this hitherto virgin subject I must acknowledge my indebtedness to officers of the Adjutant General's branch and also of the Medical Directorate at Army Headquarters, India.

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- [12] G. of I., letter of December 2, 1931.
- [13] I.A.O. 777 of October 25, 1935.
- [14] A.I.I., No. B. 186 of August 14, 1928, with amendments in 1932 and 1933.

## DUTIES OF A QUARTERMASTER'S DEPARTMENT IN PEACE.

BY CAPTAIN (QUARTERMASTER) J. G. EVES, M.B.E.,  
*Royal Army Medical Corps.*

*(Continued from p. 37.)*

### (3) DIETS, EXTRAS, AND RATIONS.

THIS heading deals with diets and extras for patients and the rationing of R.A.M.C. personnel.

The system of feeding patients is briefly as follows :—

Regns. M.S.A.  
1938, paras. 125  
and 126.

A patient comes into the hospital and is sent to a ward. A diet sheet (Army Form I.1202) is made out for him. The medical officer sees him and orders the diet and extras that he considers the patient should have.

Regns. M.S.A.  
1938, para. 248.

The sister in charge of the ward collects all the diet sheets and from the particulars given thereon compiles what is called a Diet and Extra Sheet Summary, Army Form F. 734. On this she orders the diets and extras and perishable articles required for next day and such unperishable articles as are now wanted.

S.O. R.A.M.C.  
1937, para. 206.

When these are received by the steward he prepares his provision ticket (Army Form I. 1218) in duplicate, the component parts of each diet and extra are entered on this form, one copy goes to the superintending cook and one copy is retained by the steward who attaches to it all Army Forms F. 734 received for the day. This provision ticket shows all diets and extras for issue to each ward on the day given on the form.

S.O. R.A.M.C.  
1937, para. 207.

The ingredients required in the hospital kitchen for making up the various diets are worked out by the steward in accordance with the scales laid down in Allowance Regulations and issued daily to the superintending cook.

S.O. R.A.M.C.  
1937, para. 201.

The steward has then to prepare requisitions on Army Book 188, for the daily supplies required to feed the patients in accordance with the diets and extras ordered. These are sent to the Officer i/c Supplies and to the various contractors concerned. The Officer i/c Supplies generally provides a list each half-year of the names of the contractors and the items which they contract to supply.

S.O. R.A.M.C.  
1937, para. 128.

Perishable articles such as meat, fish, chickens, fresh fruit and fresh vegetables, are delivered daily, and they are inspected on arrival by the Quartermaster or his representative to see that the quantities as ordered have been received and by the orderly medical officer to ensure that they are up to standard.

Regns. M.S.A.  
1938, para. 135.

In effect the Quartermaster is responsible as regards quantity and the medical officer as regards quality.

S.O. R.A.M.C.  
1937, para. 205.

The whole of the transactions in the steward's store are accounted for in Army Form F. 730 which is the stock book of supplies, and the entries are made each day throughout the month.

This Army Form consists of several sheets, the left-hand side sheet

showing supplies received each day and the right-hand side the issues each day. The receipts are taken from the items delivered by the Officer i/c Supplies or contractors in accordance with the daily indents and the issues are taken from the items shown on the daily provision ticket, Army Form I. 1218.

At the end of each monthly period the stock book of supplies (A.F. F.730) is closed and balanced, and on the following morning the stock in the steward's store as shown on this form is verified by an officer who signs a certificate to the effect that this has been done and that the stock agrees with the balance shown.

Also at the end of each period Army Form F. 731—account of receipts and issues—has to be prepared. This form is similar to the stock book of supplies except that it does not record daily receipts and issues. It shows the sources from which the supplies have been received and how issued, and the totals should agree with those given in the Stock Book. On the front page of this Army Form (that is A.F. F.731), particulars have to be given as to the cost of feeding officer, soldier, and family patients. This costing is shown under two headings, one of which is food and the other wines, spirits, etc.

This form after completion in all respects is forwarded to the Officer i/c Supplies. S.O. R.A.M.C.  
1937, para. 208.

#### *Rations for R.A.M.C. Personnel.*

Persons entitled to rations are briefly as follows :—

Home and abroad : Officers and soldiers, full ration.

A11 c. e. Regns.  
1938, para. 22.

Stations abroad only : Wife of soldier on married establishment, half ration. Children eligible in respect of family allowance, quarter ration.

The full scale for home stations is laid down in Allowance Regulations, but at the discretion of the Army Council certain items need not be drawn. Usually only such items as bread, meat, flour, sugar, and salt, are drawn in kind. For the other items making up the standard ration a cash allowance is admissible in lieu. In addition a messing cash allowance for the purchase of necessary additional articles of messing is issuable.

A11 c. e. Regns.  
1938, para. 29.

The standard ration for each station abroad is in the first place submitted for the approval of the Army Council, and if approved is laid down in the Local Allowance Regulations of the Command.

A11 c. e. Regns.  
1938, para. 30.

Indents are submitted as required (usually daily) to the Officer i/c Supplies on Army Book 55A. A11 c. e. Regns.  
1938, para. 32.

Groceries and non-perishable articles are drawn once a week from the supply depot, but perishable articles such as meat and bread are generally delivered daily for consumption on that day.

Under the present-day system it is not necessary to adhere strictly to the scale laid down, but in cases where a unit overdraws the amount of overdrawal is debited by the Paymaster. A11 c. e. Regns.  
1938, para. 32.

The procedure is that at the end of each monthly period the Officer i/c

All c. Regns.  
1938, para. 93.

Supplies forwards to the unit A.F. F.3179 (in duplicate) in which he shows the quantities and prices of the supplies he has issued during the month. The unit then completes the form by entering : (1) The stock in hand at the end of the preceding month ; (2) the amounts of the items actually consumed during the month ; and (3) the balance still in hand. The cost of the items consumed is then worked out and entered on the form, the original is returned to the Officer i/c Supplies, and the duplicate is forwarded to the Regimental Paymaster.

All c. Regns.  
1938, para. 95.

The Regimental Paymaster then checks the details on Army Form F. 3179, and compares the cost of the items consumed with the value of the total rations admissible as given in Form 2(C) of the Company Account (A.F.N. 1504A).

If the value of the provisions consumed is less than the entitlement, the unit is credited with the amount ; on the other hand should it be greater, the amount is debited by the Regimental Paymaster against the C.O.R. Allowance.

All c. Regns.  
1938, para. 70.

At stations where the whole ration is drawn in kind, the Regulations allow certain equivalents which may be drawn, such as oatmeal in lieu of bread or biscuits, cocoa in lieu of tea, flour in lieu of bread, dried fruit in lieu of jam, sausages in lieu of bacon.

In connexion with the improvements in the soldiers' messing generally throughout the Army instituted during 1937, considerable changes were made as regards issue of rations in kind and allowances in lieu (A.O. 65/1937).

#### (4) FUEL, LIGHT, DISINFECTANTS, ETC., AND ACCOUNTING FOR THESE.

S.O. R.A.M.C.,  
1937, para. 209.

Indents for such items as coal, wood, oil, cresol, methylated spirit, etc., are made on Army Book 30 to the Officer i/c Barracks.

All c. Regns.  
1938, para. 158,  
Note (6), p. 88.

The supply of coal and kindling wood for military hospitals is based on an approved estimate of the amount it is considered will be required for the fuel year.

The O.C. Hospital is requested to submit estimated requirements in coal and wood for the coming fuel year, and, provided Headquarters agrees, the amount estimated is authorized as the allowance for the year under review.

Regns. S.T. &  
B.S. 1930, para.  
566.

When coal is received from the contractor, the hospital steward and a representative of the Officer i/c Barracks (generally the local E.S.A.) inspect it as to quality and check in the loads. In some Commands the coal is received in sacks and in one-ton loads. At least two sacks from each load are weighed.

S.O. R.A.M.C.,  
1937, para. 209.

Records of receipts of coal are kept in Army Book 65 ; we show also in this book how the coal has been issued. In addition, for the sake of convenience and as a record for reference when compiling the return for each fuel period, particulars are entered in A.B. 65 in regard to receipts and issues of wood, oil, methylated spirit, etc.

Regns. S.T. &  
B.S. 1930, para.  
567.

Indents for wood, oil, methylated spirit, etc., are submitted as and when required, but in the case of coal a month or two months' reserve at the winter scale of issue has ordinarily to be maintained.

Regns. S.T. &  
B.S. 1930, para.  
568A.

In the case of hospitals, a return showing receipts and issues of coal and kindling wood, together with the stock in hand, is rendered every fourth month on Army Form F. 727, and for paraffin oil, methylated spirit and candles on Army Form F. 771. Regulations do not call for such items as cresol, lime, naphthalene, and formaldehyde to be accounted for in any return submitted by the O.C. Hospital.

S.O. R.A.M.C.  
1937, para. 129.

Regns. S.T.&  
B.S. 1930, para.  
589.

As stated above, the Fuel and Light Return is rendered (to the Officer i/c Barracks) every four months. The account rendered at the end of each fuel year has to be balanced. Any saving on the amount allowed as compared with the actual consumption is given up, that is it cannot be carried forward to the next fuel year as a credit. On the other hand, should the hospital burn more than its allowance, then Headquarters require an explanation in support of the application for the amount to be written off as a charge against the public.

A 11 c e. Regns.  
1938, para. 185  
(b).

In effect, a hospital fuel and light account definitely closes each year at the end of each fuel year and an entirely fresh account is started for the next fuel year.

The other fuel and light account is that for the R.A.M.C. Company. This is rather different from that for the hospital.

Issues in this case are governed by scales as laid down in Allowance Regulations. A definite scale of coal is allowed weekly for each type of quarter, cookhouse, mess, library, reading room, school, and so forth.

A 11 c e. Regns.  
1938, paras. 157  
and 158.

Scales of fuel in the various Commands abroad differ from those allowed for home, and are fixed according to seasons by each Command. These rates, after approval by the Army Council, are embodied in the Local Allowance Regulations for the Command.

A 11 c e. Regns.  
1938, para. 152.

A record is kept, in this case S.O. Book 129, in which are shown in detail issues to individuals and buildings of the Company, throughout each fuel period, that is each four months, and from this book, together with the record of receipts, the company fuel and light account is compiled.

A 11 c e. Regns.  
1938, para. 153.

The fuel and light account for the Company is rather more complicated than the hospital one, but provided an accurate record of the issues is maintained one cannot go far wrong, and the actual stock in hand is a check.

As already stated, the hospital fuel and light account definitely finishes at the end of each fuel year, but in the case of the Company the account is a running one, i.e. the balance debit or entitled credit is carried forward to the next year's account. In cases where the account shows a debit balance, an application for the "write-off" of issues in excess has to be made at the end of the fuel year.

A 11 c e. Regns.  
1938, para. 185  
(c).

A 11 c e. Regns.  
1938, para. 167.

At the end of the fuel year, credit balances of kindling wood are surrendered when the fuel account is closed, but credit balances of coal or coke may be converted to kindling wood to reduce debit balances. For scales of conversion see Allowance Regulations, 1938, para. 153.

A 11 c e. Regns.  
1938, para. 185  
(a).

The scale of fuel for quarters, messes, reading rooms, schools, libraries, etc., varies according to the season, one rate for summer and one for winter ;

A 11 c e. Regns.  
1938, paras. 157  
and 158.



for example the winter season at home is from October to May inclusive and the summer season from June to September.

#### (5) HOSPITAL CHARGES.

S.O. R.A.M.C.  
1937, para. 180.

At the end of each month the Quartermaster is responsible for the preparation of any charges which should be made under regulations for the treatment of officer and soldier patients in hospital.

Regns. M.S.A.  
1938, paras. 97  
and 481.

Army Form O.1643 being used for military personnel (officers, other ranks and families), and Army Form O.5135 for other Government Departments, i.e. Navy, R.A.F., Colonial and Dominion Forces, Indian Army, etc.

In the case of in-patient treatment no charge is made for the day of admission.

Officers on full pay are charged 2s. 6d. a day unless their incapacity is due to service in the field, in which case they pay nothing.

— Officers on half-pay have three different daily rates :—

All c. e. Regns.  
1938, para. 63  
(c) (i) (ii) and  
(iii).

(1) If admitted on account of wounds or illness contracted in the field they pay the sum fixed as the higher rate of ration allowance, without meat element.

(2) If the illness was not contracted in the field, but is otherwise due to military service, they pay 2s. 6d. in addition to the above rate of ration allowance.

(3) If admitted for ordinary illness the charge is usually 12s. per day.

This rate of 12s. a day is the usual charge for any officer admitted to a military hospital who is not normally eligible for treatment from military sources. In the case of non-entitled officers admitted to the Q.A. Military Hospital, Millbank, a special charge of 23s. per diem is made.

All c. e. Regns.  
1938, para. 63  
(d).

Soldiers are normally entitled to free treatment, but if admitted suffering from sickness due to their own fault or certified by a medical officer to be caused by an offence under the Army Act committed by them, they then are charged 1s. 6d. a day, or 9d. in the case of boys, or in the case of local troops, i.e. the Royal Malta Artillery and the King's Own Malta Regiment, 10½d. and 8d. respectively.

All c. e. Regns.  
1938, para. 63  
(e)

Soldiers detained in hospital after discharge from the Army or after transfer to the Army Reserve are treated as free patients.

Soldiers' wives admitted to Military Families' Hospitals are also charged. Those on the married establishment if admitted on account of illness pay nothing, but when admitted for confinement a charge of 1s. a day is made up to a maximum of £1. This charge for confinement is made because they are receiving treatment at the cost of the State at the same time as they receive full maternity benefit.

Wives of soldiers not on the married establishment are charged at the rate of 1s. a day for ordinary illness and when admitted for confinement they are charged in addition the 1s. a day on that account subject to a maximum of £1.

Members of the Q.A.I.M.N.S. and Queen's Army Schoolmistresses are treated free. A 11 c e. Regns.  
1938, para. 63  
(g).

No charge is made for the children of soldiers on the married establishment and for whom married allowance is issuable, when admitted to hospital, but for those not on the married establishment 1s. a day is charged unless admitted suffering from infectious disease and for the safety of the troops, when they are treated free. A 11 c e. Regns.  
1938, para. 63  
(h).

Children over age of both classes are also treated free when admission is necessary for the safety of the troops. A 11 c e. Regns.  
1938, para. 63  
(h) (iii).

In the case of officers and men of the Royal Navy, Royal Air Force, Dominion Forces, Indian Army, or British Forces in India when chargeable to Indian Funds, charges are preferred against the Departments concerned at the rate of 12s. a day for officers and 10s. for others. A 11 c e. Regns.  
1938, para. 63  
(m).

Similarly, any of those just mentioned who are afforded any of the special forms of out-patient treatment such as opaque meals, normal radiography, X-ray treatment, massage, are charged at the various rates laid down in Allowance Regulations. A 11 c e. Regns.  
1938, para. 63  
(n).

Before concluding this article, there is one small Department which might be mentioned, and that is the pack store.

Briefly what happens in a normal case is this : A patient after admission to a ward is instructed to go first of all to the linen store for his hospital kit, i.e. his blue clothing, underclothing, crockery and cutlery, for which he signs in Army Book 42. The original copy is retained by the linen store-keeper and the duplicate by the ward.

After having changed from regimental to hospital clothing he takes his regimental clothing and kit to the pack store (except certain items of small kit which he is required to keep in the ward with him). The articles handed into the pack store are entered into Army Book 182 (Pack Store Inventory), and this is signed by the pack storekeeper and the patient. The original copy of the inventory is taken to the Quartermaster's office and retained there until the patient is discharged, when it is re-issued to the patient to allow him to draw his personal belongings out of store. S.O. R.A.M.C.  
1937, paras. 224-  
234.

If a patient has any valuables on admission they are taken over by the Quartermaster, who prepares a receipt in triplicate in Army Book 191. The original copy is sent to the patient's commanding officer with the valuables, the duplicate goes to the patient, and the triplicate copy is filed. S.O. R.A.M.C.  
1937, para. 179.

After a patient has handed his clothing into the pack store, his soiled linen is taken from his kit and sent to the laundry. This washing is carried out at the public expense and the laundry account is passed once a month to the Command Paymaster for settlement.

On discharge the patient obtains his kit from store and signs Army Book 182 in acknowledgment and afterwards hands his hospital clothing into the linen store. If there are any deficiencies he pays for them by signing a personal charge in Army Book 51. S.O. R.A.M.C.  
1937, para. 233.

**HANDING AND TAKING OVER—MILITARY HOSPITAL AND COMPANY, R.A.M.C.**  
*Relevant Regulations.*

*Military Hospital.*

- (i) Regulations for the Medical Services of the Army, 1938 :—
  - Para. 65. Military hospitals where there is no Quartermaster.
  - Para. 69. Books and regulations—*see also* para. 101.
  - Para. 100. Write to Garrison Engineer and Officer i/c Barracks and ask if they will detail a representative to be present. Draw up programme of inspection of : (a) Barrack Equipment and (b) Engineer fixtures. Stocktaking of articles in Linen Store comes under (a), and report showing result of stocktaking should be made out on A.F.I. 1227. The Quartermaster (where there is one on the staff of the hospital) does the above with Barrack or R.E. Representative.
  - Para. 101. Transfer documents. Action to be taken after handing and taking over.
  - Paras. 102 to 104. Read for guidance.
  - Paras. 325 to 327. Note for guidance.
  - Para. 385. Test accuracy of stock of medical equipment. Should be done personally by officer taking over. Forward certificate as required by this paragraph.
- (ii) Regulations for Supply, Transport, and Barrack Services, 1930 :—
  - Para. 652. *Re* signing Long Roll (A.B. 126a), hospital copy of which is kept by the Quartermaster.
  - Para. 656. *Re* representative of Officer i/c Barracks being present at handing over charge from one officer to another.

*Company R.A.M.C.*

- (i) Regulations for the Clothing of the Army, 1936.
  - Paras. 12 and 373. *Re* stocktaking board on clothing and necessities, and report on A.F. H. 1164 also certificate *vide* para. 373. Statement signed by Company Officer giving number of Great-coats actually in possession of personnel has to be attached to H. 1164.
- (ii) Regulations for the Equipment of the Army, 1932 :—
  - Paras. 18 and 19. *Re* holding Stocktaking Board.
  - App. 1, para. 5. Gives form of certificate to be signed by President and Members of Board, also Officers handing and taking over.

*Military Hospital and Company.*

- (i) Financial Instructions, 1931 :—
  - Para. 480. As an Officer taking over charge may have to sign certified claims for payment in connexion with supplies, stores, etc., a specimen of his signature (in duplicate) should be sent to the Command Paymaster.
- (ii) Clothing Regulations, 1936, para. 383 and Equipment Regulations Part I, 1932, Appendix I, paras. 4 and 15. Requires that ledgers should be balanced to date on : (1) Change of Command ; (2) change of Quartermasters.

## MILITARY HOSPITALS—CHOICE OF SITE AND DESIGN.

BY MAJOR P. N. WALKER-TAYLOR, M.D., B.S., F.R.A.C.S.,

*Royal Army Medical Corps.*

THE threat of extensive aerial bombing of towns and cities is one of the more important of the new tactical considerations involved in this war. It is apparent that it affects the activities of all communities, civil, industrial, military, etc., within the theatre of war, but it is not perhaps so apparent how it particularly affects the Army Medical Service in the matter of hospital accommodation. In the last war, where the number of civilian casualties at bases some distance from the actual fighting and at home (England) was negligible, many military hospitals (general, special, convalescent, etc.) were conveniently set up in civil hospitals, schools, and other similar large buildings already standing in those areas and already equipped with water, electric power, and so on. Naturally buildings of this description normally stand within the boundaries of fair-sized civil communities (towns and cities). In the present war where, as is cautiously anticipated, one thousand or fifty thousand casualties may suddenly occur in any large town or city and require immediate attention, it is obvious that these central hospitals or potential hospitals must be kept available for civilians. In other words, these cannot be used, or even kept in reserve as military hospitals; others must be found or built.

When a hospital is projected in a certain region a medical officer (generally of fairly senior rank) will be one of the first persons from whom an opinion and recommendations are required, and it is the purpose of this communication to represent some of the considerations on which such an opinion and recommendations might be based.

Without entering into too great length and detail, the following would appear to be the main general considerations for the construction of a military hospital under current conditions :—

(1) *Strategic and Tactical Considerations.*—These of course, are the prime consideration and are entirely the concern of the War Office (or G.H.Q. abroad). By them it is decided whether there is to be a hospital at all and in what region.

(2) *Decentralization.*—Spacing is the best protection from air attack. It is as well to remember the massing of headquarters, hospitals, stores, etc., in places like Etaples in the last war which invited and duly received a certain amount of devastation; this war the possibilities of devastation are greater. Decentralization means amongst other things inconspicuousness and elusiveness of target, and in this connexion a degree of isolation of the hospital will be striven for not only from large towns but from other large concentrations of buildings or troops. It is not by any

means certain that display of a red cross will protect hospitals from attack ; in any case from great height these distinguishing marks are difficult to see.

(3) *Accessibility*.—It is obvious that if a hospital is to do its job in receiving convoys of sick and wounded, in treating them, and in evacuating them as quickly as possible, either back to the firing line or home, it must be served by good roads and not be too far distant from other established means of communication, i.e. railways, canals, rivers, or ports. A balance must be struck between decentralization and accessibility.

(4) *Practicability*.—Under this will come practicability for building, i.e. availability of materials, water supply, power, etc.—the hospital may either have to be entirely built, or largely built as an addition to an existing building—and practicability for use as a hospital, i.e. healthiness of site, drainage facilities, etc.

These matters are more the concern of the R.E., but must be borne in mind by the medical authority.

#### CHOICE OF SITE.

(A) *Abroad*.—The above general considerations will apply, but the varying conditions encountered in theatres of war abroad, type of country, type of inhabitants, type of warfare, whether mobile or comparatively stationary, will introduce many special considerations. Thus in a theatre of war, for instance, base hospitals might be built very similar in conception to hospitals in England, but in other theatres, permanent constructions might not be built at all, and reliance placed on hospital ships or hospital trains. In all theatres of war abroad, however, this special rule will hold :—

General hospitals where wounded and serious cases are dealt with (this is intended to exclude such special hospitals as neurological) should never be so close to the seat of fighting as to be in danger of disorganization by gunfire or indiscriminate air raids on the forward lines of communication, or so distant as to cause undue delay primarily in treatment and secondly in returning cured casualties to the front.

(B) *At Home (Great Britain)*.—Military hospitals in Great Britain during war serve : (i) Units on active service in Great Britain, (ii) units training—at scattered points all over Great Britain, (iii) casualties transferred from a theatre of war.

The situation of such hospitals will be chosen according to the simple principles of common sense, i.e. where the concentration of troops demands them. Economy will be served by having in a certain area a large hospital centrally situated (e.g. in the centre of a triangle at whose points, thirty miles apart, three separate units are training) rather than a multiplicity of smaller hospitals. Where military hospitals are already in existence in cities or large towns, which are otherwise well catered for as regards hospital accommodation for civilian casualties, no doubt these hospitals should continue to function rather than be left vacant ; but in all other cases where

a new military hospital is to be established, the aforementioned general considerations, particularly decentralization, will apply.

#### CHOICE OF DESIGN.

These remarks apply both at home and abroad, for after all the object of hospitals, curing the sick, does not differ all over the world, and generally the methods do not vary overmuch either ; therefore, if an efficient design for a hospital of specific size and nature (say a general hospital of 600 beds) can be decided upon for one region, it should prove effective, with minor variations due to climate, etc., for other regions as well. It will be realized that in these remarks I am only referring to military hospitals with particular reference to the emergency situation of a time of war. I have already said that in some cases hospital ships or hospital trains will take the place of ordinary immobile or permanent units. Again, special hospitals of every kind require special divergencies from normal considerations, therefore in discussing the matter of design, to save the time and looseness involved in attempting in a short article to deal with all exceptions, I propose to deal with the explicit instance of a general hospital of 600 beds.

This will be the procedure : The War Office or G.H.Q. will decide that a general hospital for 600 beds will be built in a certain region. A staff officer, possibly accompanied by an officer of the Royal Engineers, will inspect the region and, bearing in mind the general considerations of suitability mentioned above, will select several sites on which specialists will then be asked to report. The strategy or tactics of the campaign may demand that the region inspected be circumscribed, a wilderness, a deserted shore, built over, or otherwise incompletely suitable ; nevertheless a site must be selected. On the other hand, and generally, the region indicated will offer fair choice, and a number of sites will be selected under two headings: (A) An existing building, (B) a bare site.

#### (A) *Existing Buildings.*

In the specified region there may be one or a number of large buildings ; for example, hotels or country houses. The staff officer knows that if a hospital is required it is in all probability required to function as soon as possible. He says to himself here is a ready-made building fairly near a railway, which is already served by water, electric power, and reasonable roads ; surely with a few adjustments this can be made to serve as the nucleus of a military hospital in a very short space of time indeed. All this is quite true so far as it goes ; after perhaps only moderate constructional adjustments a certain number of medical officers, nurses, and supplies could be moved in and a limited number of patients could be attended in it quite quickly, but if it is intended to visualize this place from the start as a fully equipped and fully functioning military hospital of 600 beds, there are a number of other considerations which must be immediately reviewed.

(1) *Costs.*—(a) *Constructional adjustments* of major or minor extent will always be necessary in converting any building into a hospital no matter what its final size. For a hospital which is to house 600 patients with operating theatre, X-ray plant, cooking arrangements, etc., this constructional adjustment will almost certainly be of major extent. This is Cost 1.

(b) *Additional Buildings.*—The personnel alone of a 600-bed hospital is fairly considerable, and this requires to be housed and fed in addition to the 600 patients. Also it must not be forgotten that accommodation must be found for the various special departments which may in time have considerable out-patient attendance (dentist, E.N.T. and eyes), as well as for the several hospital stores of large bulk (linen, medical, steward, and pack store). Windsor Castle might have sufficient space for all this without additional building, but practically speaking, it is safe to say that additional building of some extent will in every case be required—and generally of large extent. This is Cost 2.

Costs 1 and 2 plus the cost of hire or purchase of the original building are compared with estimated costs of a hospital entirely built *de novo*.

(2) *Time.*—Estimated time of completing or partially completing a hospital built on an existing-building nucleus is compared with estimated time of building a hospital *de novo*.

(3) *Efficiency.*—The estimated efficiency of a hospital built on an existing building nucleus is compared with the efficiency of a hospital built entirely *ad hoc*.

After the staff officer, therefore, has submitted several possible sites for a hospital, specialists will be asked to report on them, and the first of these will be a medical officer, if possible the officer who is to have charge of the hospital when built. His report will consist of (1) a statement of the building, surroundings, and position, as to suitability of site ; (2) a statement of (a) the estimated accommodation and adaptability of the building and (b) the constructional adjustments and additions required ; (3) he may or may not include an opinion as to the estimated efficiency of the hospital when completed and compare it with an alternative which he may present.

In some cases a practical or professional consideration, not appreciated by the staff officer, may present itself to the medical officer (e.g. all staircases may be too small for a stretcher carrying a lying case), which rules out the building for a hospital altogether. This will be stated.

This report will be quickly inspected with an eye on the two considerations, cost and time, and if the project still seems reasonable other specialists R.E., Q, etc., are asked for reports. Their reports deal with the feasibility of the required alterations, and the estimated cost and time, and on receipt of these reports action is taken either discarding the project or proceeding with it immediately.

It will be seen that in submitting his report, the medical officer has in effect submitted his design for the completed hospital, for in his requirements for alterations and additions he must make provision for all departments of

the hospital as well as future expansions. Therefore, it is as well that at the time of making his preliminary inspection, he should be in clear possession of all that a general hospital of this size means. Unfortunately a comprehensive statement of all these requirements is not easy to obtain and he must rely upon his experience. Attached to the diagram which accompanies this article will be found a list of departments which is broadly comprehensive.

(B) *A Bare Site.*

I think there can be little dispute that a hospital built *ad hoc* must be more efficient than any makeshift, no matter how scientifically elaborated. Therefore, if the decision were left to the medical officer to make choice between the two alternatives discussed here: (a) An existing building, (b) a bare site, there is no question that in a hundred cases to one he would select the latter. He would know that war hospitals such as are under consideration would in all probability not be built of permanent material but of wood or canvas; however, with central heating of huts such as is now general and good planning of buildings, there is never any objection to the former in any climate or weather; and as regards tents, if these are only used in summer or in hot climates, there is no objection to them either. Nevertheless vital considerations of cost, time, and even availability of materials (such as timber for huts) must often override the matter of comparative efficiency. If not, an entirely new hospital will be built.

In planning it, any ideas of imitating a modern civil hospital, of which scores of splendid scientific models are seen going up every year, must be put completely out of mind, for the following are some of the considerations which make the two cases quite different:—

(1) Temporary materials; there will be no multiplicity of stories, elevators, etc.

(2) Likelihood of devastation by high explosives, etc.; a scientific balance of spacing and accessibility is again the rule.

(3) Provision for unlimited expansion.

(4) Provision for the accommodation and feeding of the company apart from the hospital itself.

I submit a suggested plan for a military hospital of 600 beds.

The plan is almost self-explanatory.

A space of open ground is understood to have been chosen which meets the general considerations: strategy, decentralization, accessibility, practicability.

The aspect of the hospital is southerly, and the wards are built in echelon obliquely to this direction with future extensions at right angles to each unit forming a herringbone pattern. By this arrangement the wards catch the maximum of sun but, more important, they are spaced with a kind of regular irregularity, so that not only is the destructiveness of a bomb or shell explosion minimized—a low-flying aeroplane with a machine gun which had mistaken the nature of the construction would do less damage in a



B.R. Board Room  
 B.K.R. Barrack Room  
 C.O. Officer Commanding  
 Coy. O. Company Officer  
 C.D.H. Company Dining  
 Hall

CL. Company Clerks  
 C.ST. Company Clothing  
 Store

D. X-ray Development  
 D.O. Dental Officer  
 E.St. Equipment Store  
 E.N.T. Ear, Nose and  
 Throat

E.T. Eye Testing

G. Garage

G.D. Guard

H.D.H. Hospital Dining

Hall

H.K. Hospital Kitchen

H.P.C. Hospital Clerks

K. Kitchen

L. Linen Store

L.S. Soiled Linen

LAB. Laboratory

C.R. Company Ration

Store

INC. Incinerator

# GENERAL HOSPITAL FOR 600 BEDS

## PRELIMINARY SITE PLAN

SCALE OF ONE : ONE THOUSAND OR THEREABOUTS



M. Medical Ward  
 MOR. Mortuary  
 M.S. Medical Stores  
 MT. Matron's Office  
 N.C. N.C.O.s' Canteen  
 O.M. Officers' Mess  
 O.M.O. Orderly Medical  
 Officer  
 O.P.W. Out-Patients' Wait-  
 ing Room  
 M.ST. Meat Store  
 F.ST. Fuel Store  
 Q.CL. Quartermaster's  
 Clerks

O.i/c M. Officer in Charge  
 of Medical Divi-  
 sion

O.i/c S. Officer in Charge  
 of Surgical Divi-  
 sion

O.T. Operating Theatre  
 O.Q. Officers' Quarters

PH. Dispensary

X.R. X-ray Room

T.P. Trailer Pump

C. Carpenter's Shop

P. Ho. Power House

STE. Sterilizer  
 TEL. Telephone Operator  
 F.E. Future Extension  
 PATH. Pathologist  
 P.M. Post Mortem  
 PREP. Preparation Room  
 PRE.O. Pre-operation  
 P.S. Pack Store  
 Q.M. Quartermaster  
 REC. Receiving (Casual-  
 ties)

RES. Resuscitation

S. Surgical Ward

S.N. Sanitary Annex

S.W. Surgical Walking

Cases

SS. Sisters' Duty Room

SS.M. Sisters' Mess

SS.Q. Sisters' Quarters

ST.S. Stewards' Store

S.M. Sergeants' Mess

S.Q. Sergeants' Quarters

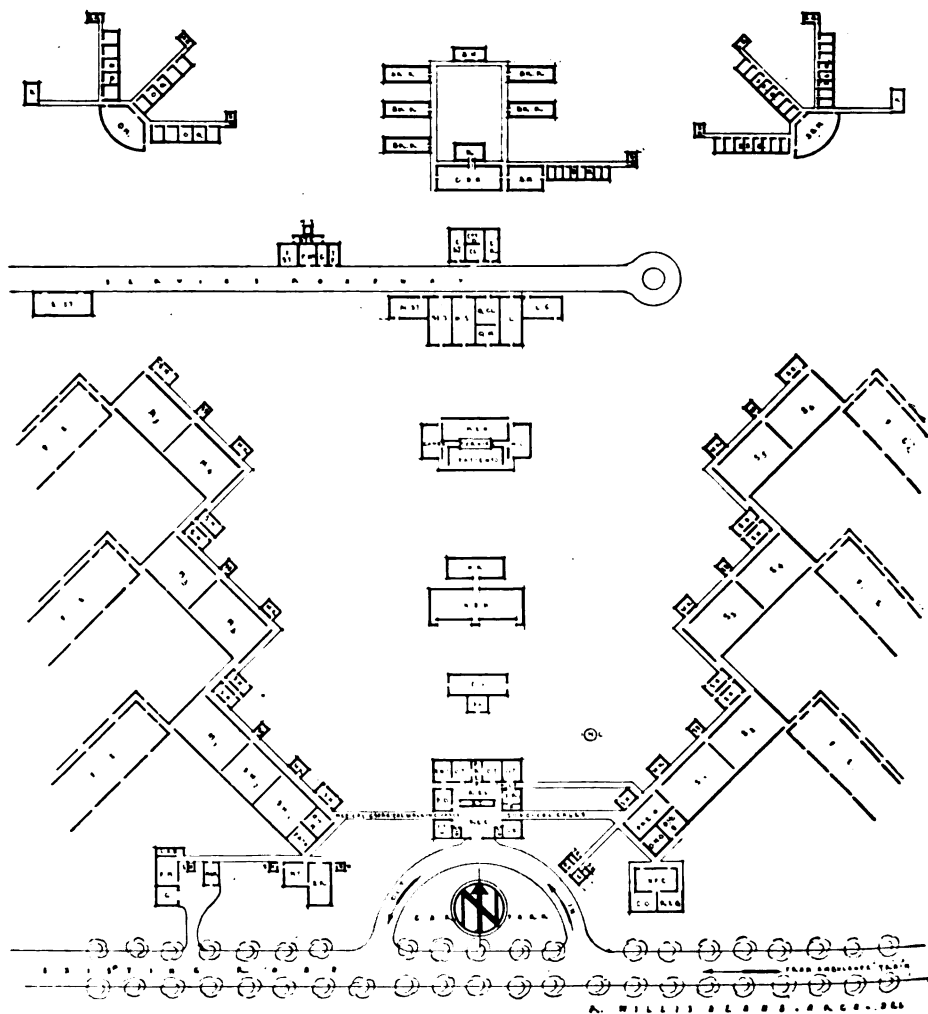
REG. Registrar

W.K. Ward Kitchen

W.T. Water Supply Tank

W. Waiting Room

S.R. Surgeon's Room



600

straight line in any direction. It will be seen that spacing is the keynote of the plan, but accessibility is well served in that the essential community arrangements such as dining halls, kitchens, stores, etc., lie in the centre.

In front a one-way drive will conduct ambulances or inquiries past the guard hut to the receiving room ; this also is the evacuating room, and so the drive conducts vehicles or foot passengers out again. At the guard-hut inquiries are made and directions obtained. The C.O.'s office, registrar's office, and hospital office are nearby. The receiving room leads readily to a resuscitation ward and immediately contiguous, centrally, are the operating theatres. The X-ray department is also conveniently in this block and it is considered that hereabouts also is the most suitable place for the departments of the otologist and dentist, who will frequently require X-ray and anæsthetic assistance. Further back, centrally, is the dispensary and pack store. Next the hospital dining hall with kitchen attached. Next the N.A.A.F.I. and recreation section, which is used both by hospital and company.

Next behind come the hospital stores with the quartermaster's office supervising. In the plan a service roadway is made in the rear of the wards which conveniently divides the hospital proper from the company section. All the stores of both hospital and company abut on to the roadway for the convenience of supply trucks, etc. Beyond the roadway are grouped the company arrangements, and on each flank is grouped an officers' block, one for medical officers, the other for nursing sisters.

If the site allocated is not sufficient in depth, the last-mentioned group of buildings—stores and company—could, with little loss of efficiency, be placed on the other side of the main road in front of the hospital.

The wards as shown in this plan are of groups of two in series of 50 beds each ; thus there are 600 beds in the original plan, but the suggestion as to size of wards is not hard and fast. The wards' various annexes may be seen.

Provision is made for other rooms which experience will show to be desirable : a board room (for medical boards, courts of inquiry, etc.) ; offices for matron, for officers in charge of medical and surgical divisions ; room for orderly medical officer. The pathologist's laboratory, which medical officers will often visit to see their own specimens personally, is situated somewhat centrally ; the mortuary, autopsy room, and animal laboratory is hygienically removed from the centre but convenient for the pathologist and the road.

The plan does not purport to be drawn carefully to scale, its main purpose being that of a diagrammatic reference (which does not appear to exist already) for the ready consultation and guidance of officers—medical officers in particular—who may be called upon for an opinion or recommendation in the construction of a military hospital.

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## Editorial.

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### THE MYSTERY OF ALIMENTATION.

IN the Oliver-Sharpey lectures delivered before the Royal College of Physicians, London, on March 12 and 14, Professor E. P. Cathcart refers to the inadequacy of our knowledge concerning many of the fundamental processes governing the utilization of food in the body.

As it is impossible in two lectures to deal with the whole field of metabolism, Professor Cathcart has confined his attention to the unknown, or part of the unknown, in connexion with the metabolism of protein and calcium. He has called the lectures the Mystery of Alimentation because of our ignorance concerning the intricacies of the problem. He states that mystery or no mystery, we have to deal with one of the very fundamentals of physiology—the proper provision both quantitative and qualitative of food.

Great emphasis has been laid on the improvement of physique which would necessarily result from improved food intake. There is clear evidence that in many areas there has been a steady increase in the heights and weights of school children. In relation to food intake growth in man is slow compared with many other animals, and generally speaking food will have far less influence on growth than might be expected from experiments on small fast-growing laboratory animals. Fisher wrote "Experimentally the growth response to increased nutrition is found to be remarkably small and it is difficult to show that even this small response is of permanent developmental importance."

While it is freely admitted that growth restriction in the young may result when they are given an inadequate diet, there is good evidence from animal experiments to show that the ability to grow is retained for long periods. Though similar experiments on children are not possible, there is much indirect evidence that the recuperative powers of children are also great. Palmer, from a study of the school attendance cards of 4,000 elementary school children, came to the conclusion that there was no significant association between height and weight and sickness. From a study of 415 subjects Hardy concluded that there is no indication of any generally retarding influence of illness *per se* on physical growth.

Cathcart points out the shaky foundations of nutritional knowledge. He says that many investigators have been far too prone to accept average data, particularly on the quantitative side, as being absolute standards, and to pass judgment on diets as being adequate or inadequate irrespective of the place of origin, mode of life, racial habits, and so on of the consumers.

Average figures have a value, but they have definite limitations. Their use has led to the assumption that as regards dietary habits all men are alike both in their tastes and their consumption. Further, the assumption is made that the data from which these average figures, and ultimately standards, are derived have been obtained from materials of constant composition. We know that the amount of protein, minerals, and vitamins present in vegetable foodstuffs varies with the season, type of fertilizer used, type of soil, and the like, within quite wide limits. Our so-called standard analyses of foodstuffs have not the fixity of value which is commonly assumed. Our knowledge of basic metabolic processes is equally defective. Basal metabolism is founded on a series of assumptions. Basal values obtained vary with the nature of the food consumed before the test. If rich in protein the basal metabolism will be high, whereas if carbohydrate predominates it will be low.

As a rule the average respiratory quotient of a healthy man lies between about 0.7 and 1.0. We assume that reactions giving rise to an R.Q. over unity represent a conversion of sugar to fat and those below 0.7 are regarded as evidence of bad technique, or if the low R.Q.s persist as possible evidence of conversion of fatty acids to some carbohydrate compound. Yet despite all these assumptions it is admitted that the results in practice do afford much useful information regarding the energy needs of the organism. This happy practical result is due to the physico-chemical phenomenon that the caloric equivalent of oxygen, no matter for what purpose it is used in the body, is remarkably constant, a fact which has been shown by the work of Leagard.

Cathcart selected protein and calcium for special consideration. As regards protein it is assumed that the nitrogen output affords a reliable guide to the katabolism within the tissue cells. The possibility that some of the wholly or partially katabolized protein is used for rebuilding is ignored. The metabolism of protein is thought of as taking place by itself, while there is abundant evidence that this metabolism is largely influenced by the presence of carbohydrate or fat.

Experiments on the starving subject suggest that fat can and does act as a sparer of protein in the absence of carbohydrate, and Lusk states that in starvation when there is no fat, protein may burn exclusively. It is generally accepted that carbohydrate is the fuel of choice for the performance of muscular work, yet Lusk believed that in starvation when the body has to rely on its tissue stores, the energy of muscular contraction is afforded by the oxidation of fat. The assumption that nitrogen excretion reflects exactly the protein metabolism of the tissues is approximately true if the experiment is of long duration, but that it cannot apply to the daily turnover is shown by the fact that if a subject is in a state of nitrogenous equilibrium and an extra ration of protein is superimposed the resultant increased output of nitrogen is spread over three or four days, yet if a waste product like urea is superimposed in place of protein the excess nitrogen is excreted within a

day. Cathcart states that the mystery of protein metabolism does not end here. Protein is our principal source of sulphur, and experiments have shown that sulphur and nitrogen are excreted at different rates after their ingestion in the form of protein, and very special changes occur during the course of metabolism which would be impossible to explain on any simple combustion theory. When anabolic activity predominates in the tissues the sulphur is more quickly taken up than the nitrogen, and when katabolism holds the field sulphur is more rapidly excreted than the nitrogen.

Cathcart maintains that there is another phase of the protein problem—its biological value that has lost its original beautiful and apparently logical simplicity. To-day it is laid down by those interested in dietetics that the perfect or optimum diet should contain a certain proportion of its protein in first-class or “high biological” form. There are able investigators like Terroine, who deny the necessity of including first-class protein in the diet, but who admit that if the protein value is low and of poor origin supplementing it with a certain amount of first-class protein may be useful. Generally it has been assumed that the biological value is something static, whereas it has been shown that the biological value varies inversely with the concentration of protein in the diet. Hamilton has shown that when whole egg protein constitutes 4 per cent of the diet its biological value is 100, at 12 per cent it is 84, at 16 per cent 62, and 50 per cent its value has fallen to 20. All values above 16 per cent must for technical reasons be regarded with reserve. Hamilton, in his experiments with rats, showed that as the proportion of egg protein increased from 4 to 16 per cent in the diet of growing animals, the growth-promoting value of the diet also increased. Diets containing 16 to 30 per cent were equal as growth-promoters, but when the protein was increased above 30 per cent growth-promotion decreased. Slonaker also found that maximal growth in rats took place when the diet contained 14 to 18 per cent of protein. In Slonaker's diet the calories from protein formed from 12 to 15 per cent of the total calories. Taking Hamilton's 16 per cent as the optimal protein concentration, it is found that protein calories formed 13.8 per cent of the total calories ingested. In this connexion Cathcart recalls that the proportion of protein calories ingested in the diet of the average man lies between 10 and 14 per cent.

There is another aspect of the problem of biological values which is related to the amino-acid make-up of the proteins. Biological values are not of necessity cumulative. Proteins which are deficient in the same amino-acid will not supplement one another in a diet, but if two proteins differing in the amino-acid deficiency are combined together they will supplement each other, as when meat proteins are combined with flour proteins. In this supplementary action lies the value of a good mixed diet in everyday life. The addition of proteins derived from animal sources such as meat and milk will increase the food value of a diet mainly made up of cereals.

Rubner pointed out that when proximal principles, particularly proteins, were fed to animals they gave rise to a definite production of heat—specific

dynamic action he called it. Though the extra heat is useful for warming the body, it cannot be used for muscular work.

Cathcart states that in recent years the specific dynamic action of proteins has again aroused attention, sometimes under the title thermogenic action. He says that the thermogenic action of foodstuffs is not the same at all levels of feeding. Hamilton has suggested that the specific dynamic action of food depends on the purposes for which the food is utilized in the animal body. He has found that the specific dynamic action decreases *pari passu* with each increase in the percentage of protein in the diet up to the level of about 18 per cent; it then remains constant between 18 and 30 per cent and thereafter increases with diets which contain 42 per cent and over of protein.

Cathcart quotes Lusk: "We may conclude . . . that if a mixed diet be so constituted as to conform to the needs of the tissues and be slowly introduced by absorption from the intestine, the specific dynamic action is virtually negligible; and when there is great undernutrition the gradual digestion, absorption and deposit of fat, added in excess of the body's requirements, may be accompanied by little or no manifestation of specific dynamic action." In other words the more perfectly balanced the diet for any particular organism the greater will be the efficiency with which it is utilized, the smaller will be its specific dynamic action and the greater will be its net energy value.

Voit suggested that the average adult diet should contain 118 g. of protein a day. The Technical Commission on Nutrition of the League of Nations suggested 1 g. per kg. of body-weight would suffice. Cathcart says it is difficult to decide the point finally for various minima of nitrogen output can be determined. Von Fürth concluded that there were three definite protein minima: (1) The endogenous minimum, the minimal output of nitrogen in the urine, after a period on a protein-free but calorie-rich diet. This is a physiological minimum of only academic interest. (2) The physiological minimum which is reached when, with a calorie-rich diet, nitrogen equilibrium can be attained. It means that an intake of 45-50 g. of protein a day will suffice. (3) The hygienic or practical minimum which is the amount of protein which will keep a man healthy and fit for work. Von Fürth placed this value at 75-90 g. of protein a day. Generally speaking, calories derived from protein should form 10-14 per cent of the total calories ingested.

In the establishment of a hygienic minimum the quality and balance of the diet plays a notable part. Corry Mann found that when he included milk in his diet he could carry on in perfect health on a lower calorie intake than when he used meat as the source of his protein. There is a close relation between the katabolism of protein and calorie intake, a connexion more intimate than the katabolism of protein to furnish energy. It has been shown that above a relatively low protein intake nitrogen equilibrium on an adequate diet can be readily established; when the subject is underfed,

although there may be a fair amount of protein in the diet this equilibrium cannot be attained ; there is a steady loss of nitrogen, even greater than in complete starvation. Benedict points out that when the diet contains an inadequate supply of calories the loss of nitrogen bears no relation to the enormous reduction in basal metabolism. Cathcart states that in ordinary feeding when nitrogen equilibrium can be attained there is a definite phase of anabolic activity, an active resynthesis, whereas in the state of underfeeding the constant but inadequate supply of food may merely stimulate katabolism. He considers that the anabolic phase of protein metabolism is too often ignored. There is evidence that the protein ingested is not immediately katabolized. There appear to be two types of protein retention : the first type of retained protein may be conceived as that which is essential for the maintenance of growth, the second being transitional, the type which is rapidly metabolized. Too often it is supposed that the individual constituents of a diet are separately oxidized ; it is probable that they become an integral part of the living cell before they undergo the metabolic changes which lead either to transmutation or destruction.

Although there is a definite demand for protein from those who carry out hard muscular work, there is no scientific evidence that the body requires an increased intake of protein for this purpose. There is, however, evidence that the most virile races are large consumers of animal protein. Cathcart asks why does the popular demand outrun scientific knowledge. Is the diet not properly balanced ? Or is the protein required in larger amounts for the maintenance of cell structures ? In his study of the relation of protein intake to the efficiency with which hard muscular work was performed. Wishart found that his subject reached his best performance on a high calorie diet rich in protein of animal origin.

As the other example of the difficulties which confront our accurate interpretation of alimentation Cathcart chose the calcium need. The standards have fallen in connexion with advancing knowledge. Two or three decades ago Tigerstedt held that a man required 7 g. a day, whereas the Sherman standard postulates 1 g. as optimal for the average adult. It is difficult to speak of the absolute needs of calcium as the need is governed by the amount of phosphorus and vitamin D available. A difficulty in computing the requirement of calcium is that the excretion of this is mainly in the faeces, only about one-fifth appearing in the urine. Part of the material excreted through the intestine has never left the gastro-intestinal tract, having formed compounds which cannot be absorbed. Cathcart thinks it is questionable whether excretion, other than in the digestive juices, takes place to any extent in the intestine. He considers that Sherman's standard requirement for calcium is based on data which are difficult to accept, and the figure of not less than 1 g. per day for adult maintenance has been given greater significance than its origin justifies.

Leitch, as a result of a statistical study, concluded that the daily requirement of an adult is reached with an intake of 0.55 g.

Berg does not believe it is possible to lay down any specific quantity of mineral substance as being necessary, for the need is dictated by other factors in feeding. Durig is of the same opinion. The conclusion that the time is not ripe for rigid standards is supported by the first report of the Advisory Council on Nutrition in the Commonwealth of Australia.

It has always been assumed that the calcium in milk is readily utilized by children, but Kinsman, Outhouse and Mitchell, have shown that the utilization figure for pre-school children is only 20 per cent, a very different figure from 98 per cent obtained by Ellis and Mitchell in their experiments on rats.

Cathcart writes that in view of the difficulties surrounding the excretion of calcium it is interesting to note that there is some evidence that the calcium which is released in endogenous metabolism may be re-utilized by the organism. Output does not give an exact clue to the changes taking place in living cells. Bone is often regarded as a mere static skeleton component, whereas it is an active site of metabolism.

There is the further difficulty, that although a proper amount of calcium may be ingested, there may be present in the diet some other material, such as oxalic acid, which will combine with the calcium and render it unabsorbable. Spinach is rich in oxalic acid and experiment has shown that if milk and spinach are taken together there is a definite reduction in the amount of calcium used.

With regard to the metabolism of calcium in connexion with rickets and osteomalacia, there are many difficulties to explain. Wilson has found that in certain districts of the Punjab, where rickets and osteomalacia are rife, the diets are grossly deficient in calcium and vitamin D. This might be anticipated, but in another district where environment and diets are similar and the food equally deficient, rickets and osteomalacia are almost unknown.

There is yet another assumption in the discussion of diets which is known to be false—that modern man consumes the same food day in and day out all the year round. Cathcart suggests that it is physiologically unsound to aim at an optimal intake day after day—an intake which probably contains an excess of all the essential proteins, salts, and vitamins. The body was designed with high “factors of safety.” It does not lead a hand-to-mouth existence. Indeed one might say that variability in the supply of food is a more admirable physiological arrangement than constancy of provision.

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## Clinical and other Notes.

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### GAS CLEANSING CENTRES, FIRST-AID POSTS, AND THEIR COUNTERPART IN THE FIELD.

BY CAPTAIN W. A. ROBINSON,

*Royal Army Medical Corps.*

*Instructor in an Army Gas School.*

GAS cleansing centres and first-aid posts are terms familiar to all concerned with passive air defence. Details of these are found in "Protection Against Gas and Air Raids, Pamphlet No. 3." The principles involved will be considered in this article, and an attempt made to show their application in the field.

For details, Pamphlet No. 3 should be read in conjunction with this article, Plans No. 1 and No. 2 being reproduced from this pamphlet.

The teaching given in the pamphlet replaces that given in "The Medical Manual of Chemical Warfare, 1939"; the terms "decontamination centre" and "first-aid post and decontamination centre," referred to in the manual are no longer used, and have been replaced by the terms "gas cleansing centre" and "first-aid post." As a result medical officers should realize that the unit is responsible for cleansing men who are "contaminated only"; these men are not dealt with by the medical services unless they are showing eye symptoms or signs of blistering, and therefore may become casualties. It is, however, the responsibility of the medical services to cleanse "contaminated wounded" as well as to give medical treatment.

#### GAS CLEANSING CENTRES.

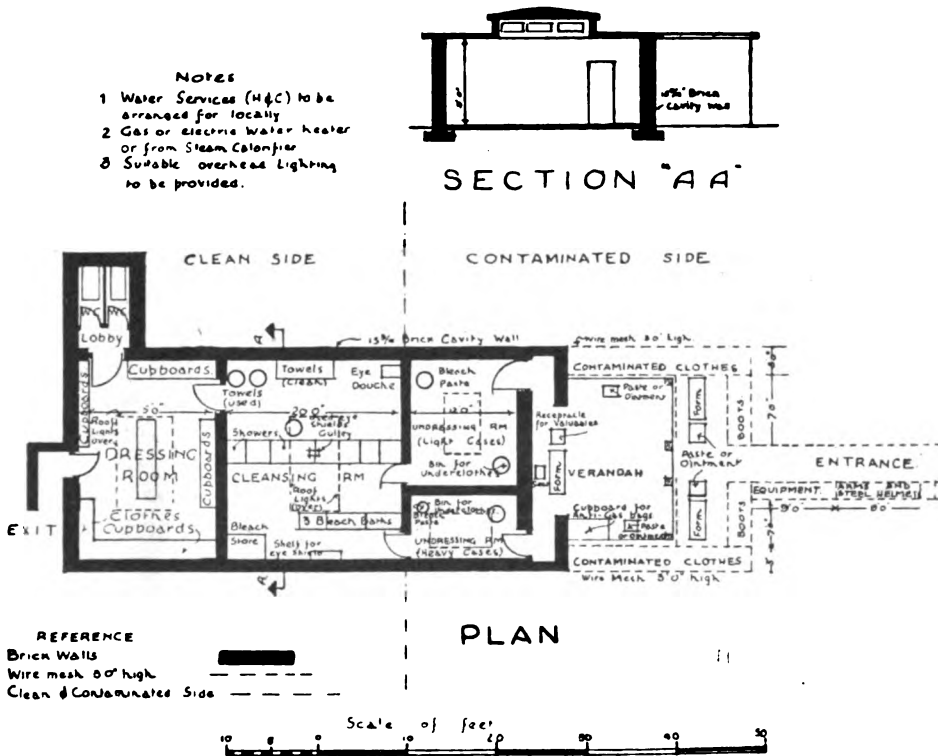
These are designed to cleanse *unwounded* personnel who have been contaminated by blister gas through exposure to the vapour of these gases, or as the result of contact with the liquid.

Provision is made on a scale which will ensure that all personnel will be cleansed within ten minutes of liquid contamination.

#### THE COUNTERPART TO GAS CLEANSING CENTRE IN THE FIELD.

It is obvious that it is not possible to establish buildings, described in Pamphlet No. 3, in the forward areas. The principle involved in these centres can be applied in the field without the erection of any special buildings. A study of Plan No. 1 of a gas cleansing centre will reveal that there must be a "clean and dirty line" clearly marked between the undressing room and the cleansing room. No man may cross that line until all his clothing and equipment have been removed.

Three separate areas are essential. An area for contaminated anti-gas clothing, an area for cleansing, and an area for clean clothes, respirator and ointment. Only those who are heavily contaminated require a bleach bath. The counter part in the field therefore consists in marking out areas as described above, and having a supply of water and bleach, and a supply of clothing for men after cleansing. If there are no buildings at hand which can be adapted on these lines, then the ground will be marked off, with, if possible, some overhead protection.



PLAN 1.—P.A.D. Gas Cleansing Centre.

### FIRST-AID POST.

These posts are designed to deal with all types of casualties in an air raid on a military centre. They are not staffed by R.A.M.C. except at an R.A.M.C. depot. The men are drawn from their units and must be trained in first-aid and anti-gas measures. The responsibility of training rests with the unit commanders and medical officers of units.

The functions of a first-aid post are as follows :—

- (1) It receives all types of casualties, serious and light. These include wounded, wounded and contaminated, and choking gas casualties.
- (2) It forms a sorting station. Lightly wounded are treated and returned

to their unit, serious cases remain at the first-aid post until it is safe to evacuate to the nearest reception station or hospital. It should be noted that during an air raid it is not possible to send to hospital serious cases immediately they are collected, but they will be evacuated as soon as the raid is over.

(3) It receives both male and female. Suitable arrangements for this must be made.

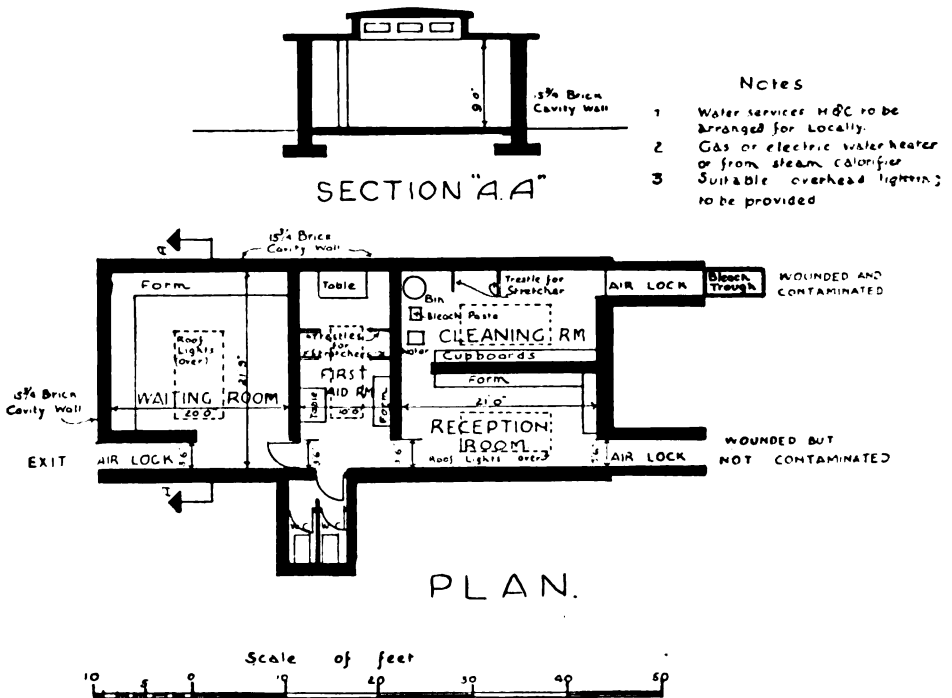
(4) It cleanses "contaminated wounded" before further evacuation. This is important as it means that after a man has been cleansed he can mix with, and be evacuated in, the same transport as the "wounded but not contaminated." One line of transport is therefore only required. Detail of procedure will be found in Pamphlet No. 3.

#### THE COUNTERPART TO FIRST-AID POST IN THE FIELD.

A study of Plan No. 2 in conjunction with detail in Pamphlet No. 3 reveals that:—

(1) There is a separate entrance for contaminated wounded, and one for wounded only.

(2) Patients who are cleansed may be evacuated in the same transport as ordinary wounded.



PLAN 2.—P.A.D. First Aid Post.

(3) By cleansing a casualty at this post he will be saved from the effects of the blister gas if he is treated early. Even if ten or fifteen minutes have elapsed, the effects will be reduced.

(4) No items are required that could not be obtained in the field. It will be noted that shower baths or baths are not necessary.

*The regimental aid post* will correspond to a first-aid post in passive air defence. All that is required is a separate entrance for contaminated wounded, and an area or room for cleansing. After cleansing, patients can be treated and evacuated with ordinary wounded. If this is done at the R.A.P. it will save the patient from unnecessary suffering and ease the transport problem.

The R.A.P. should still retain its name and *not* be called R.A.P. and Cleansing Post. The cleansing is as much a part of the work performed as is the treatment of the wound.

The difficult problem is that of personnel to staff the R.A.P. In this case it will be necessary to demand additional men to those allotted at present. Units should be able to afford these additional men, or if necessary, lightly wounded may be employed for this purpose.

The suggestions for the R.A.P. will also apply to the A.D.S. and the M.D.S.

#### CONCLUSION.

An attempt has been made to show that the functions of a gas cleansing centre and a first-aid post are distinct. The principles involved can be applied in the field. R.A.P.s should have a cleansing side, but retain the letters R.A.P.

"The old order changeth, yielding place to new" (Tennyson).

#### REFERENCES.

- "The Medical Manual of Chemical Warfare," 1939.
- "Protection against Gas and Air Raids," Pamphlet No. 3.

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## A NOTE ON THE TREATMENT OF MINOR SEPSIS.

By MAJOR D. P. LAMBERT,  
*Indian Medical Service.*

FOR the last six months the following scheme of treatment for minor septic injuries has been in force in the surgical wards of the C.I.M.H., Wana.

(1) Each patient is fully examined and is assessed as a whole—not merely as an example of a local lesion—and any factors likely to delay healing are appropriately treated. Ankylostomiasis is particularly sought for, because in the presence of this infestation wounds seem to heal very badly.

(2) Rest, general, local, or both, is assured for all patients, and with that warmth and a good blood supply to the injured part.

(3) Where the septic focus is surrounded by an area of cellulitis or where drainage is not free, dressings of warm 10 per cent sodium sulphate are used. Enthusiasts have reported very glowingly on this dressing. These reports I am not prepared to endorse in full, but in my experience the results from its use have been slightly superior to those I have previously got from other wet applications of eusol, boracic lotion, and the like.

(4) Where there is no cellulitis and where drainage is free, a sterile vaseline dressing is applied. This dressing is also used in cases of the previous group when they have healed sufficiently. The vaseline is put on the part and left on. Discharge accumulates beneath it and sometimes an offensive smell develops, but beneath the discharge healing goes on very smoothly. Patients greatly appreciate their release from the pain of a daily dressing, and when inspection of the wound is necessary the greasy lint comes off painlessly and with no tearing of granulation tissue or of delicate young epithelium beneath. A great variety of oily or greasy dressings has been suggested from time to time. Elsewhere I have used cod-liver oil, bipp, acriflavine in paraffin, and several others. None has seemed better or worse than plain vaseline, and probably their chief merit lies in their protective oiliness rather than in any more specific quality.

(5) No patient is discharged till his wounds are completely healed, and where the area of new epithelium is large it is protected for a day or two by sticking plaster. Otherwise the thin new skin is apt to be broken.

(6) These methods have been found applicable to most cases. Naturally, exceptions occur. These, as they are recognized, are treated appropriately. The most common extra call has been for a stimulating application. Raw linseed oil has proved useful here, combining as it does stimulation with oily protection.

The advantages claimed for the above scheme are five :—

- (1) Therapeutic efficiency at least equal to that of other methods.
  - (2) Great sparing of pain to the patient.
  - (3) Reduction in the time spent in daily dressings, so that fewer attendants can deal with a greater number of patients.
  - (4) Great economy. Both sodium sulphate and vaseline are very cheap, and with the latter dressing there is also a great saving of gauze and lint.
  - (5) Simplicity and universal availability.
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## WATER DIFFICULTIES IN ENGLAND.

BY MAJOR C. W. HEALEY, M.C., T.D.,

*Royal Army Medical Corps.*

WHILST the danger of the presence of coliform bacilli in water is generally known, the possibility of the increase of that danger under military conditions must always be borne in mind. Although the civil population may have escaped the risks of epidemics over a series of years, the movement of troops into rural areas may involve the introduction of carriers of intestinal infection with consequent dangers which do not exist under ordinary peace conditions.

Soon after the outbreak of war, the T.A. artillery unit to which I am attached was ordered into billets, consisting mainly of derelict country houses in a district in which no water-carriage system exists.

One anxiety that I had was, naturally, about the water supply, especially as it is general knowledge in the county in which we are that, although the town supplies are excellent, the country districts rely largely upon rather suspicious superficial wells. This anxiety heightened as the troops were urban in origin and there had been cases of paratyphoid B in their district in the previous twelve months, and of undulant fever in the billeting area.

On a preliminary reconnaissance of the new billets I got in touch with the medical officer of health for the district, the county sanitary inspector, and later the distinguished bacteriologist who works in association with them. The county sanitary inspector and myself took specimens from the three water points and later I received the following reports from the bacteriologist :—

(1) 160 presumptive *B. coli* per 100 c.c., (2) 1 presumptive *B. coli* per 100 c.c., (3) 35 presumptive *B. coli* per 100 c.c., after forty-eight hours' incubation at 37° C.

The organisms proved to be Intermediate Type II of the coliform group.

The Ministry of Health, Report No. 71, suggests that when a public water supply contains not more than two presumptive *B. coli* per 100 c.c. the sample may be regarded as satisfactory.

The bacteriologist reported therefore that in (1) and (3) there was evidence of remote sewage pollution and that the supplies should not be used for drinking purposes unless treated. The chemical examinations supported these findings.

The move into billets was completed the day before the reports were received, but orders had been given that all water for drinking, the cleaning of teeth, etc., must first have been boiled.

On receipt of the reports three water carts were indented for and received within a few days. One of these, filled from the second supply, was kept at each of the other billets, and the third was kept ready to replace any becoming empty. The men had considerable difficulty in lashing the old horse-drawn type of regimental water-cart behind the lorries (the unit is completely mechanized), but there were no mishaps.

The task of improving the first and third supplies had then to be undertaken, which meant cleaning out a well in the first instance and storage tanks in the third, which was an intermittent supply. This, however, could not be undertaken until one had ascertained that the water orderlies were not infected with typhoid or other similar organisms. The bacteriologist reported all cases negative to : *B. typhosus* H and O ; *B. paratyphosus*, A, B, and C ; *Brucella abortus* ; *B. dysenteriae* (various types) ; *B. aertrycke*, H and O ; *B. newport* ; *B. enteritidis* (Gaertner), and *B. suispestifer* (various types).

The infected sources were freely drawn on, the water running largely to waste, to cleanse the pipes and blind ends as far as possible, and fresh bacteriological examinations made a week after the cleansing operations. These showed great improvements, being as follows : (1) 25, (2) nil, (3) 3.

At the same time as the first reports were received, application was made, and strongly supported by the A.D.M.S., for a supply of T.A.B. vaccine which, in the special circumstances, was granted, and inoculation of the troops commenced forthwith.

No case of water-borne disease has occurred.

I should like to acknowledge how great a debt I owe to the medical officer of health, the county sanitary inspector, and especially to the bacteriologist, for their unstinted and invaluable assistance.

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### A CASE OF SERUM SICKNESS.

BY CAPTAIN P. N. BARDHAN, I.M.S., M.R.C.P.(EDIN.), D.P.H.(ENG).,

*Officer in Charge Brigade Laboratory, Jhansi, India.*

CASES of serum sickness are not uncommon, but the following case presented certain unusual features.

A British soldier, aged 22, in India for about a year and generally healthy, was given a subcutaneous injection of 500 American units of a standard preparation of antitetanic serum on June 27, 1939. He did not have any A.T.S. injection before this.

On July 1 he developed malaise, stiffness of the neck, intense headache, fever of 102.8° F. and rigors, and he was generally very ill. The onset was sudden and he was brought to hospital in less than two hours from the onset of the illness.

Examination showed the absence of Kernig's sign, a flush on the face, slightly enlarged axillary glands, markedly enlarged and tender occipital glands, and a total absence of sepsis anywhere. There was no delirium and the toxæmia was moderate. The other systems were normal, except for tachycardia and hurried respirations, which were consonant with the temperature.

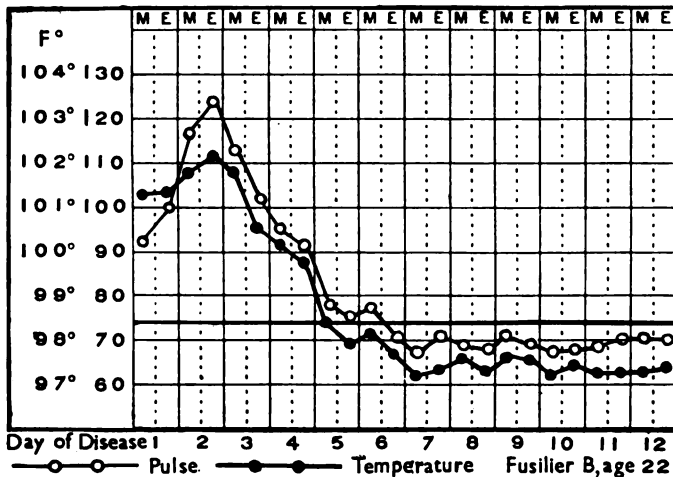
On July 2 a macular rash appeared round the site of the injection on the right arm, and ultimately the rash measured 4 inches by 2½ inches. It lasted for five and a half days. The symptoms worsened to some extent coincidentally with the appearance of the rash; the glands were rather more enlarged, but the spleen was not palpable at this or at any other stage of the disease. The fever abated on July 5.

Blood-films were examined for malaria parasites daily and none was found. The urine showed slight albuminuria on the third and the fourth days of the disease, but no other abnormality. The total white count was made on July 2, and showed 10,700 leucocytes per c.mm. of blood. The differential count showed: Polymorphs 8,350 per c.mm. of blood; lymphocytes 1,920; eosinophils 215; monocytes 215. Another blood-count made on July 4 gave almost identical results.

The cerebrospinal fluid was under pressure, about five drops to a second, but otherwise the fluid was entirely normal. The lumbar puncture incidentally relieved the headache considerably.

Blood taken on July 2 was sterile, and agglutination reactions against the enteric, typhus, and the Brucella groups were negative with the blood taken on July 3. The Wassermann and Kahn reactions were negative both with the blood and the cerebrospinal fluid. Radiography of the cervical spines done on July 2 showed no abnormality.

Treatment was mainly symptomatic. On July 6 the patient developed slight sore throat, but there was no constitutional disturbance. The condition subsided in three days.



The glandular enlargement subsided on July 12, and recovery was complete by July 15. There has been no after-effect to date, and the soldier is doing full work.

*Discussion.*—Adenitis is one of the rarer features in serum sickness. Except for the enlarged glands there was no evidence of glandular fever.



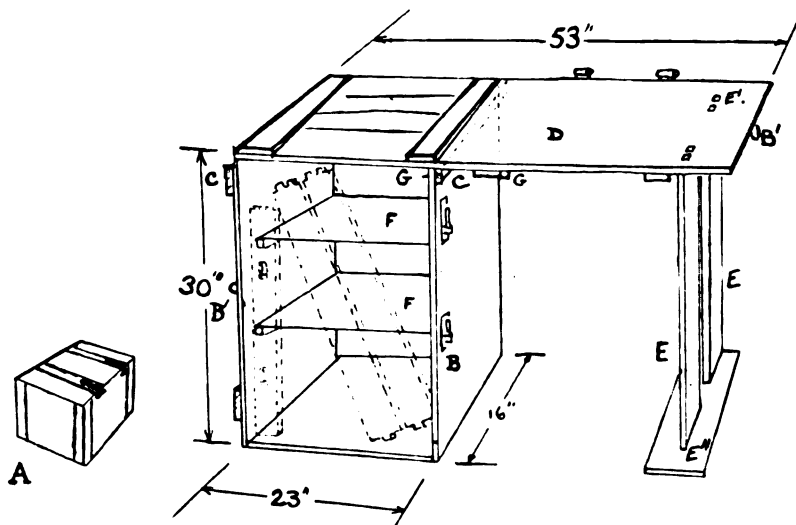
The temperature chart was unlike that of sandfly fever. The history of the injection, the rash, the fever, and the quick recovery, are all features in favour of a diagnosis of serum sickness. The symptoms of meningitis might have been associated with the tender and enlarged occipital glands, but the cause of the swelling of the glands was not clear.

I am grateful to the Officer Commanding the British Military Hospital, Jhansi, for permission to send this case for publication, and to Assistant Surgeon L. G. Hull, I.M.D., for his assistance in the investigation of the case. I also thank Professor F. R. Fraser, M.D., F.R.C.P., of the British Post-Graduate Medical School, London, for help in the preparation of this article.

### THE "M" BOX TABLE.

BY COLONEL E. M. COWELL, C.B., C.B.E., D.S.O.

THE accompanying illustration shows a simple method of improvising a portable table. The contents of the shelves are accessible without being unpacked. The table is strong enough to allow of typing being done with a heavy machine.



A, Packing case as received from ordnance, 23 by 16 by 30 in. B, Gate hinges and B' clasp and staple for padlock. C, Battens, to support end. D, Lid, resting on batten and supported on legs. E, E, legs, made from packing-case wood. Carried as shown by dotted lines. F, Moveable shelves of 3-ply. Note—room is left for the three parts E, E, and E'. G, Nails, for string used to lash the lid to the box.

A carpenter can carry out the necessary work very quickly, and the cost amounts to less than two shillings per box.

A seat is improvised from a smaller sized packing case.

A CASE OF PNEUMONIA WITH AN EOSINOPHILIA DEVELOPING  
AFTER M & B 693.

By MAJOR E. MASON BARKER,  
*Royal Army Medical Corps,*

THE following case, which came to my notice recently in a general hospital, appears to be worth recording :—

Gunner A. H., aged 19, service one year. Admitted March 13, 1940. Transferred to U.K. March 26, 1940. Diagnosis : (1) Rubella ; (2) lobar pneumonia.

*History.*—On March 4, 1940, nine days before admission to hospital, the patient complained of a “ cold ” and sore eyes. There was an undefined rash on his arms, legs, and abdomen. His condition improved steadily while with the field ambulance, the rash had disappeared by March 8, and on March 10 he felt quite well. On March 11 he developed a slight cough and his temperature rose to 102° F.

Treatment with M & B 693 was commenced ; the patient was given two tablets four-hourly.

The next day his temperature was still high, there were no physical signs in the chest, but he had the appearance of a case of pneumonia.

On March 13 he was transferred to the General Hospital.

*Condition on Admission.*—March 13, 1940 : Temperature 102·6° F., pulse 104, respirations 58. The patient now had a typical lobar pneumonia on the right side. He was slightly cyanotic and there was a rash on the limbs and trunk resembling rubella. The cervical lymph glands in both posterior triangles, the axillæ, and the groins, were enlarged.

*Progress.*—Treatment with M & B 693, 2 tablets four-hourly, was continued.

March 15 : 6 a.m., temperature 101° F., pulse 126, respirations, 56. Milk diet. 6 p.m., temperature, 99·4° F., pulse 90, respirations, 40.

The pneumonia condition had improved, but he was still slightly cyanosed and his lymph glands were still enlarged. The rash was now more urticarial in character, it was not so bright in colour, but was more confluent and widespread, slightly raised and very irritating.

Treatment with M & B 693 was discontinued at 10 a.m., March 16.

March 16 : 6 a.m., temperature 100° F., pulse 120, respirations 48. Milk diet. 6 p.m., temperature 101·4° F., pulse 128, respirations 44.

His condition was unchanged. His blood-count was : Hæmoglobin 105 per cent ; erythrocytes 5,900,000 per c.mm. ; colour-index 0·9 ; leucocytes 38,000 per c.mm. ; neutrophil polymorphonuclears 95 per cent, 37,100 per c.mm. ; lymphocytes 4 per cent, 1,520 per c.mm. ; monocytes 1 per cent, 380 per c.mm.

March 17 : 2 a.m., temperature 103° F., pulse 100, respirations 42. Milk diet. 10 a.m., temperature 102·8° F., pulse 100, respirations 52.

The right side of his chest was now almost clear, but in the lower axillary

region on the *left* side there were definite physical signs of a pneumonia. He was still cyanosed, but the rash was fading and the swelling of the lymph glands was diminishing. The spleen was not palpable.

March 18 : 6 a.m., temperature 103·6° F., pulse 128, respirations 28. Milk diet. 6 p.m., temperature 99·6° F., pulse 112, respirations 36.

There was slight impairment of breath sounds at the bases of both lungs, but there were no adventitious sounds. He was less cyanosed. He complained of "heaviness and soreness" of the eyes and there was marked œdema of the lower lids, but no conjunctivitis. There was no albuminuria.

March 21 : 6 a.m., temperature 102·2° F., pulse 118, respirations 24. Milk diet. 6 p.m., temperature 100·8° F., pulse 104, respirations 24.

There was now a profuse coarse desquamation of the face, trunk, and limbs. The œdema and soreness of his eyes were less.

March 22 : 6 a.m., temperature 103·2° F., pulse 110, respirations 26. Fish diet. 6 p.m., temperature 102·2° F., pulse 100, respirations 28.

There was still some impairment of breath sounds at the right base. The profuse scales of epithelium were removed by olive oil and revealed pin-point purpuric spots all over the body, including the palms of the hands.

March 25 : 6 a.m., temperature 98·2° F., pulse 88, respirations 20. Chicken diet. 6 p.m., temperature 97·2° F., pulse 88, respirations 20.

A leucocyte and differential count and a blood culture were performed ; the latter was negative while the differential count was : Leucocytes 18,000 per c.mm. ; neutrophil polymorphonuclears 40 per cent, 7,200 per c.mm. ; eosinophils, 50 per cent, 9,000 per c.mm. ; lymphocytes, 9 per cent, 1,600 per c.mm. ; monocytes 1 per cent, 180 per c.mm.

*Comments.*—The occurrence of lobar pneumonia as a complication of rubella is in itself rather unusual, but the point which attracted my interest was the difference between the two differential counts. The fall from 38,000 to 18,000 leucocytes per c.mm. in seven days is quite consistent with the use of this drug, but is worth observing. The real interest lies in the marked eosinophilia of 50 per cent, giving an absolute count of 9,000 per c.mm., which appears in the second differential count.

The presence of rubella in the early stage of the illness rather detracts from the value of the case perhaps, as an eosinophilia does occur in that condition, and this may be held to be the cause in this particular case. However, most of the evidence is against that ; the high leucocytosis in the first count and the development of the very marked eosinophilia in the second, with the skin condition of a very different type from that seen in rubella and the œdema and soreness of the eyes, lead one fairly to assume that the condition was an allergic reaction with an eosinophilia due to the use of M & B 693.

I wish to express my thanks to Colonel S. G. Walker for his kind permission to send these notes for publication, and to Brevet Colonel J. O. Thomas. M.C., T.D., R.A.M.C., and Major J. F. Ward. R.A.M.C., for their kind co-operation.

## Current Literature.

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**Health and Empire.<sup>1</sup> THE PROBLEM OF VENEREAL DISEASES IN WAR-TIME.** 1940, v. 14, 151-9.

This anonymous article seems to be a plea for the early development of co-operation in education and military control designed to prevent or control the danger, ever present in war-time, of the spread of venereal disease in troops and in the civil population. The paper is mostly composed of statements derived from various writings bearing on experiences in the last war. From these the following seem to be of chief interest. The number of V.D. cases dealt with in the last war was approximately 400,000 and they required in-patient accommodation amounting to 23,800 beds; 12,500 in England, 9,000 in France, 965 in Italy, 1,000 in Egypt, and 400 in Salonika—a great drain on expert services. The risk of infection from exposure without precautions was calculated at about 3 per cent both by British and U.S. authorities. In the Australian Army 60 per cent of the infections were from prostitutes; in the British Army 60 per cent were from amateurs. Men are divisible into three groups, those who must have sexual intercourse, the casuals, and the ever-continent; the middle group is that on which the educational work must be concentrated. The article discusses penalties for contraction of V.D. and the value of prophylaxis, as also the brothel system in France. In connexion with the question of prophylaxis the article then quotes the well-known comparison by Queyrat in which troops provided with prophylactics showed a lower rate of decrease of V.D. than did those not so provided. Finally is quoted the opinion of “a prominent Public Health Officer” that “the problem of venereal disease in the Army should be attacked on two lines: by education of the soldier and by military control. These two lines of attack should be developed simultaneously and in co-operation, but it is of the first importance that the one balances the other. If education alone is relied on it can too easily degenerate into a *laissez faire* policy; on the other hand, measures of military control alone are apt to lead the soldier to think that prostitution is receiving official recognition.

“In order to co-ordinate these measures of education and military control it would be most desirable in his view that a Central Committee for controlling venereal disease in the Army should be established in the War Office, composed of representatives from the R.A.M.C., the Chaplains’ Department, and the Provost-Marshall Branch. Their main function would be to co-operate with the local authorities in Great Britain and with foreign Governments in efforts to control venereal disease and to act as an Advisory Body to the Army Council on the subject of the prevention of venereal disease amongst the troops.

“The need for immediate treatment after exposure is stressed on all

<sup>1</sup> This abstract is of special importance at the present time.

sides—the urgent need at the moment is to provide education designed to prevent the contraction of disease. Time may be on our side in dealing with our visible enemies, but every day's delay in dealing with these hidden enemies is dangerous.”

L. W. HARRISON.

*Reprinted from “ Bulletin of Hygiene,” Vol. 15, No. 6.*

**BUXTON, J. B., and GLOVER, R. E. Tuberculin Tests in Cattle. Observations on the Intradermal Tuberculin Test in Cattle with Special Reference to the Use of Synthetic Medium Tuberculin. Privy Council : Agric. Res. Council. A.R.C. Rep. Ser. No. 4. Pp. v + 94, 14 charts. 1939. London : H.M.S.O. (1s. 6d., postage extra).**

This monograph is the natural outcome of a previous report in which the technique of the double intradermal test for cattle was laid down. [Medical Research Council Special Report Series No. 94, 1925. Very briefly, the test is performed by injecting from 2 to 3 millimetres below the epidermis of the shaved skin 0·1 cubic centimetre of tuberculin and repeating the dose from forty-two to seventy-two hours afterwards in exactly the same manner, the point of the needle being inserted obliquely in the fold of the skin so that the point lies in about the centre of the swelling caused by the first injection.]

Since then, occasional erroneous results have been reported, and the present monograph is the result of investigations carried out with a view to limiting these errors. A good deal of debatable ground is covered, such as the relative merits of the various tuberculin tests, the use of synthetic medium, tuberculin specific and non-specific reactions, desensitization and doping, and non-specific sensitization. From a previous investigation by Buxton, it was known that intradermal inoculations of tuberculin did not desensitize tuberculous animals against subsequent tests provided entirely fresh areas of skin were selected. Further investigations recorded here were made to determine whether zones of hyper-sensitization or desensitization might occur to any appreciable extent. These showed that in strongly allergic animals well-defined areas of increased sensitivity develop around the site of the original tests up to a period of two weeks, thus indicating that when it is necessary to retest cattle with tuberculin by the intradermal route, it is probably advisable to select areas which are at a distance of at least 6 inches from the site of the original inoculation in order to avoid these zones. It was also noted that the test as carried out in the caudal fold was less sensitive than that carried out in the skin of the neck, but there was no fundamental difference between the reaction of the two sites. Attempts made to “dope” animals against an intradermal reaction by intravenous injections of tuberculin gave results which were not regarded as outside the range of normal fluctuations of allergic animals and afforded no evidence that desensitization had been induced. It was shown, however, that unheated tuberculin protein was capable after three or four preliminary injections of inducing reactions of a positive nature, but that tuberculins

which had been heated in the course of their preparation were not capable of producing this effect. The authors consider, therefore, that it would be unwise to use undenatured unheated tuberculins for the routine testing of cattle.

Attempts were made to sensitize non-tuberculous animals against a synthetic medium tuberculin with *C. pyogenes*, *C. Preisz-Nocard*, *Actinomyces bovis*, *Actinobacillus* and *M. phlei*, but without success. It was noted, however, that when suspensions of *Brucella abortus* in gum acacia and olive oil or in normal saline solution were given by the subcutaneous route, a proportion of the animals became temporarily sensitive to old tuberculin. The number of animals available for this test was, however, too small for conclusive deductions to be drawn. Some degree of cross sensitization was noted in the course of John's disease and natural infection with the avian strain of tubercle bacillus.

Finally, attempts were made to infect four normal animals by the mouth with the avian bacillus. Apart from insignificant lesions in one case, no evidence of infection was obtained at autopsy or by cultural methods, but the animals gave transient reactions to avian tuberculin.

S. ROODHOUSE GLOYNE.

Reprinted from "Bulletin of Hygiene," Vol. 14, No. 9.

REPLOH, H., and GÄRTNER, H. Untersuchungen ueber die Entkeimung von Wasser mit erhöhtem Salzgehalt, unter besonderer Berücksichtigung des Meerwassers. [Experiments Concerned with the Disinfection of Waters of High Inorganic Salt Content with Special Reference to Sea-Water.] *Arch. f. Hyg. u. Bakt.* 1939, v. 122, 159-76, 3 figs. (26 refs.).

Medicinal mineral waters from wells and springs are often sterile, but may become infected during the processes of bottling, etc. It may be thought that bacterial increase is retarded by the dissolved carbon dioxide, but this is not so; the authors quote several workers who have shown the survival of pathogens in such waters. Carbon dioxide has a germicidal effect only at a raised temperature.

Sea-water drinking for therapeutic purposes has become popular during recent years. Sea-water has a natural bacterial flora, colony counts varying from 250 to 30,000 per millilitre.

The authors employed a number of methods to sterilize these waters.

Filtration through sand and gravel was not sufficient to give a water of continuously good quality.

Seitz E. K. filter was tried with sea-water and successfully sterilized clear samples, but became clogged in the case of turbid waters.

The results with chlorine were inferior. *Bact. coli* suspensions were inoculated into water samples, and dose and time for sterilization were proportionate to the salt content. Where three parts per million of chlorine

were required to sterilize inoculated sea-water, one part only was needed for similarly infected distilled water. Therefore at least 3 to 3.5 parts per million of chlorine are required, which dose gives taste and odour troubles. The effects of chloramine, iodine and katadynization were not investigated.

Silver ions as "Cumasina Liquidum," a proprietary silver solution, were added to sea-water infected with *Bact. coli*, and sterilization was effected in eight hours. The cost of treatment was high (about £4 per cubic metre), and a slight brown coloration was imparted to the water.

Ozonization produced a sterile sample of sea-water; a dose of 8.7 milligrammes of ozone per minute sterilized 500 millilitres of sea-water with a bacterial count of 130,000 per millilitre in one minute, and ten minutes were required for 2,000 millilitres of water with a content of 190,000 per millilitre and a dose of 3.7 milligrammes per minute. The salt content seemed to have little effect.

The results with ultra-violet light were also very promising; a column of coli-infected water 10 centimetres wide was sterilized in five minutes. Salt solutions and sea-water reacted slightly more slowly than distilled water.

The authors investigated an ultra-violet light apparatus known as the "Uster" or "water de-germinating apparatus." The thickness of the water column could be varied from 10 to 25 millimetres. With a rate of flow of 540 litres per hour, sterilization was obtained from an initial untreated bacterial content of 75,000 per millilitre.

They suggest the large-scale sterilization of medicinal and sea-water for therapeutic purposes by means of ozone or ultra-violet light. These are considered the most practicable methods, having the added advantage of not altering the characteristics of the water. E. WINDLE TAYLOR.

*Reprinted from "Bulletin of Hygiene," Vol. 14, No. 9.*

ZANNELLI, P. Influenza delle dosi sulla vaccinazione antitifica preventiva per via ipodermica nell'uomo e negli animali. Osservazioni e ricerche sperimentali. [The Effect of the Dose of Antityphoid Vaccine given prophylactically by the Subcutaneous Route in Man and Animals. Records and Experimental Observations.] *Rendiconti Istituto di Sanità Pubblica*. Rome. 1939, v. 2, 453-88. [63 refs.]

The greater portion of this article is taken up by a review of the various types of vaccine that have been recommended for the prevention of typhoid and paratyphoid fever in different parts of the world. A useful table is included giving the number of doses and the bacterial content of each dose used in different countries. The minimum treatment is in Poland, with two doses and a total of 2,000 million organisms, and the maximum in Italy, with three doses and a total of 15,000 million organisms.

In an attempt to find out whether there is any real advantage in using large doses the author carried out experiments on rabbits. Nine groups of four rabbits of approximately the same weight were given five increasing

doses subcutaneously of a 0.4 per cent formolized vaccine made up with five smooth strains of typhoid bacilli. After the last injection their blood serum was examined quantitatively for agglutinins and bactericidins. The first group of animals started with a dose of 12.5 million and ended with one of 200 million. The ninth group started with a dose of 4,000 million and ended with one of 6,000 million. Judged by the agglutinin titres reached, and to a less extent by the bactericidal titres, the animals that did best belonged to Groups 4 to 8, the best of all being Group 5. The animals of this group received doses running from 200 million to 3,200 million. At the conclusion of the experiment resistance tests were made by inoculating the animals intravenously with a dose of 500 million living typhoid bacilli. Most of the animals died, but a few survived in Groups 4 to 9.

On the whole the author concludes that the dosage of T.A.B. vaccine used in many countries at the present time is excessive. From both statistical and experimental records there is reason to believe that a more moderate dosage would suffice to protect human beings against typhoid fever.

G. S. WILSON.

*Reprinted from "Bulletin of Hygiene," Vol. 15, No. 2.*

EMPEY, W. A., and SCOTT, W. J. **Investigations on Chilled Beef. Part I. Microbial Contamination Acquired in the Meatworks.** *Commonwealth of Australia. Council for Scient. and Indust. Research. Bull. No. 126.* Melbourne. 1939, 71 pp., 8 figs. [25 refs.]

To enable beef to be transported from Australia to England as *chilled* beef has hitherto been impracticable owing to shortness of storage life. Of three factors which condition storage life one is the extent and nature of the microbial contamination acquired in the meat-works, and the present bulletin is confined to a study of this factor. All the various sources of contamination in the slaughterhouse and in the chilling rooms were investigated, and while all may add their quota the chief source of the superficial beef microflora was the hide and hair of the slaughtered animals. The hide microflora is in part dependent on the microflora of the pasture soils on which the animals graze. The bacterial contamination was studied at two temperatures, viz. 20° C. and -1° C. While moulds and yeasts play a minor part, the main contamination is from bacteria particularly at 20° C. At -1° C. the moulds and yeasts may be 35 per cent of the initial microbial population on beef after slaughter. No detailed study was made of the types of bacteria at 20° C. but at -1° C. *achromobacter* types provided 90 per cent. The relationship of numbers of organisms to climate was fully studied and beef prepared from cattle in tropical zones always showed a small percentage of low temperature bacteria and therefore a lower susceptibility to spoilage in the chilled condition than beef prepared in more temperate regions.

After the above facts as to sources, types, and amount of microbial contamination were ascertained, a study was made as to the methods to



reduce the amount. These included preliminary washing of the animals with cold-water sprays, the use of hot-water washing, the use of disinfectants, reduction of air- and water-borne contamination, sanitary cleaning of slaughterhouse floor and utensils with the extensive use of wiping cloth, and improvements in the chilling rooms and the after processes. By the introduction of these various hygienic measures the extent of contamination of beef at the conclusion of the dressing operations was reduced to approximately 5 per cent of its former level.

W. G. SAVAGE.

*Reprinted from "Bulletin of Hygiene," Vol. 15, No. 2.*

KAY, H. D., ASCHAFFENBURG, R., and NEAVE, F. K. **The Phosphatase Test for Control of Efficiency of Pasteurization.** *Imperial Bureau of Dairy Sci. Tech. Communication No. 1.* 53 pp. 1939, October. [85 refs.] [2s.]

In this excellent bulletin the authors discuss in detail the standard phosphatase test as regards the details of its performance, its sensitiveness, the possible effects of conditions such as storage, preservatives, heavy bacterial contamination and mastitis in the cows, which might affect its utility and the results of its application to commercial "holder" pasteurization. The details given confirm the great value of the test, a fact endorsed by all who have used it.

Since other types of pasteurization, particularly "high temperature, short time" pasteurization, are now widely discussed, the authors consider its application to this type and conclude that, possibly with minor modifications, it will provide an equally sensitive and searching method of control. In U.S.A. slightly different temperature requirements are in force for holder pasteurization, and it is shown that the test can also be adapted for these differences provided certain modifications are introduced, such as shortening the incubation time and varying the colour standard.

With such a useful test it is natural that a number of modifications have been tried, partly to fit the test for U.S.A. practice and partly to simplify and make the test available for field work. These are discussed but sufficient experience is not yet acquired to assess their reliability. A further section deals with the application of the test to cream, skim milk, butter and buttermilk, cheese and ice-cream. An appendix describes in detail the methods for performing the standard test and also the various modifications mentioned.

The test, while commended by the Chief Medical Officer of the Ministry of Health, is not yet recognized officially, and defects shown by the phosphatase test cannot as such be made a basis for legal action. The authors stress that sufficient experience is now available to justify its adoption for official control purposes. This bulletin should be read and utilized by everyone concerned with the control of pasteurization and the granting of pasteurization licences.

W. G. SAVAGE.

*Reprinted from "Bulletin of Hygiene," Vol. 15, No. 2.*

HOWELL, J. B. **Checking the Efficiency of Pasteurization.** *Med. Officer.* 1939, v. 62, 218-19.

The investigations recorded all tend to confirm the value of the phosphatase test as an indicator of efficient pasteurization. Among a series of 216 samples of milk examined in the Metropolitan Borough of Hammersmith three failed to pass the test. It was discovered that in one the sample had been taken by dipping a jug into the churn, the jug having just before been used for mixing and dividing a bottle of tuberculin-tested milk, though it had been cleansed between the samplings. The second was very similar, the jug having been used for unpasteurized milk, then emptied and drained, but not wiped dry before being used again. No information was obtained regarding the third unsatisfactory sample.

Experiments were then made by which, first, one-third pint of pasteurized milk was placed in a jug which had previously contained raw milk and had not been drained or cleansed; second, in a jug which after being emptied of raw milk was drained for five minutes. Both were reported on as "raw or grossly under-heated or contaminated with raw or improperly pasteurized milk." The Lovibond blue unit value was 10+ in place of a limit of 2.3 for properly pasteurized milk. When one pint of pasteurized milk was used in place of one-third of that amount the units were 3.7 and 3.1 respectively. Even a very thin film of milk remaining when a jug has been emptied and drained can thus be detected.

H. H. S.

*Reprinted from "Bulletin of Hygiene," Vol. 15, No. 2.*

WHITBY, L. E. H. **Biological Aspect of Infected Wounds.** *Lancet.* April 6, 1940.

The author states that except in violent and fulminating infections, there is a time lag of five to twelve hours between the time of wounding and the time when the implanted infection assumes a dominating position. The time lag can doubtless be increased by chemotherapy. This is the time for the surgeon to take action. Having resuscitated the patient, the fundamental requirement both for healing and for protection against infection is a good blood supply; lacerated devitalized tissue, blood-clot, and foreign bodies encourage both aerobic and anaerobic infection. It is safer to remove all necrotic tissue drastically at first operation than when granulation tissue has formed. Interference with granulation tissue is always fraught with danger and may let loose virulent and invasive bacteria into the circulation. Once the surgical clearing of the wounded tissue has been completed immobilization of the part is required. When a wound has become infected in spite of all precautions every effort should be made to cut any vicious circle which tends to lower resistance. Good food, adequate fluids, nursing—in the open air when practicable—are all required, as well as judicious transfusion of fresh blood if long-continued toxæmia is making the patient anæmic. Chemotherapy is a valuable adjuvant provided the surgeon realizes how

ineffective are the sulphonamide drugs when pus is present and not draining freely. As to local applications, care should be taken that the irrigating fluids are more injurious to the bacteria than to the tissues themselves. For this reason there is much to be said for the employment of "lymphagogues" which encourage the exudation of natural lymph and other protective body fluids. But even lymphagogues have the disadvantage of tending to cause local œdema if they are used continuously over a long period.

**BURNS. Leading Article.** *Lancet.* May 18, 1940.

It is stated that surprisingly few of the papers that appear on burns contain careful clinical studies of the severe systemic disturbances that follow them. The theory that these disturbances are due to the formation and absorption of non-bacterial poisons from burned tissue is widely held in this country, but in America it has been abandoned in favour of Underhill's that the disturbances are due to increased blood concentration the result of plasma loss in the burned area. According to Aldrich a burn is essentially an infected surgical lesion.

Some of the conflict of opinion is probably due to the failure of writers to describe the stage and nature of the disturbance to which they refer. Often no distinction is drawn between secondary shock of which the main cause is loss of plasma, and a succeeding stage of toxæmia the cause of which is different. According to Wilson, MacGregor and Stewart, the symptoms of the toxic phase which develop under the conditions of coagulation treatment can be explained neither by corpuscular concentration nor by bacterial infection, and in fatal cases a lesion of the liver cells is found more severe than that produced by any of the common bacterial toxins. McClure, Russell Elkington, in America, have confirmed these observations.

In the treatment of burns sufficient attention is not given to secondary shock which requires infusion of human plasma, administration of oxygen in high concentrations, injection of suprarenal cortical hormone, natural or synthetic. The coagulation form of treatment is for the moment the method of choice. Many modifications of the original tannic acid introduced by Davidson of Detroit have been described but all aimed at hastening coagulation and combining more efficient antisepsis. Silver nitrate in 10 per cent solution is employed with a dye antiseptic such as gentian violet or with a 5 per cent tannic acid solution; it acts both as a coagulant and antiseptic. McClure uses hexyl-chloro-resorcinol, which is said to be strongly antiseptic but not injurious to tissue cells; it is applied with tannic acid in a water-soluble jelly base.

**Sulphur and Chemotherapy.** *Lancet.* May 25, 1940.

Sulphæmoglobin is often found in considerable quantities after the administration of sulphanilamide, and after the drug is stopped may persist for from four to six weeks. It immobilizes the hæmoglobin and is

said to appear in patients who have much sulphuretted hydrogen or soluble sulphide in their alimentary tract, which is thought to be due to an excess of combined sulphur in the diet. Some doctors forbid eggs, but while bacterial decomposition of eggs outside the body gives rise to sulphuretted hydrogen, in normal digestion the sulphur-containing amino-acids are absorbed with little formation of sulphides. It has not been shown that eggs in diet promote the formation of sulphæmoglobin when the intestine is normal. The same applies to other foods containing sulphur, like cheese. Epsom and glauber salts are prohibited because they are purgatives which hurry the fluid contents of the small intestine into the colon, and it is bacterial decomposition occurring in these liquid fæces which gives rise to sulphides. Phenacetin predisposes to the formation of sulphæmoglobin if even small quantities of sulphur are present. Aspirin is harmless in this respect. Confection of sulphur given with sulphanilamide causes sulphæmoglobin soon to appear. When giving sulphanilamide purging and phenacetin should be avoided, but the patient may have as normal a mixed diet as his condition will allow.

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### Reviews.

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**INSECT PESTS.** By W. Clunie Harvey, M.D., D.P.H., M.R.San.I., and Harry Hill, M.R.San.I., A.M.I.S.E. London: H. K. Lewis and Co., Ltd. Pp. x + 292. Price 10s. 6d.

This little volume, which sees the light of day for the first time, deals with all insect pests of importance and gives details of the best methods of control.

Its particular value lies in the practical manner in which the subject has been treated by the authors, and there is a minimum of unessential detail with a maximum of important fact.

A most useful chapter on the subject of building construction in relation to the prevention of infestation is included, while much space is devoted to practical details in connexion with the gaseous fumigants and the technique of fumigation.

The fumigation of ships, too, is most adequately described.

Educational measures in relation to insect control receive their due meed of attention, while a special chapter is devoted to the commoner pests of foodstuffs and the measures taken to eradicate them.

The legislation dealing with the control of verminous premises and persons is discussed in a simple and easily understood manner.

This handbook makes its bow at a time when the need for it is clearly great, and no one interested in the important subject with which it deals should be without it.

The authors may be congratulated on having covered a very extensive

field in a comparatively small space, and the handbook will be found invaluable as a book of reference to all those, whether in the Services or not, who have responsibilities in connexion with insect-pest control.

A. E. R.

**THE LOUSE.** An account of the lice which infest man, their medical importance and control. By Patrick A. Buxton, M.A., M.R.C.S., L.R.C.P., D.T.M.&H. London: Edward Arnold and Co. 1939. Pp. x + 115. Price 7s. 6d.

War is "lousy"; so, one might add, are those that participate in it, either actively as soldiers or passively, and most unfortunately, as refugees.

On these counts alone the time is opportune for the appearance of this small and up-to-date monograph by Professor Buxton dealing with the human louse and its wicked ways.

After a few preliminary chapters dealing shortly but adequately with the anatomy of *Pediculus humanus*, the author passes on to discuss, at some length, the individual and collective biology of these interesting insects.

He stresses the modern conception of the head and body louse as being merely biological races or variants of one species, *P. humanus*, and remarks on the interesting fact that louse populations are, in the main, small affairs; one to ten lice representing the average *per capita* infestation, whilst infestations of more than a hundred lice are relatively uncommon.

This may be true as a generalization, but it was my sad privilege to see and treat many heavily infested British prisoners of war, on duty close behind the German line, during 1918. The head infestations of many of these unfortunate and temporary "down and outs" were in some cases so heavy that hair, normally black, appeared grey by the presence and numbers of these ecto-parasites. This condition, although no counts were made, must have represented a *per capita* population of many thousands.

The most interesting part of the book, to me, is that dealing with the entomology and epidemiology of the louse-borne diseases, typhus, trench fever, and relapsing fever. This section includes an interesting and instructive account of the Rickettsiae pathogenic to man.

The author "flirts" with the theory, admittedly attractive, that murine typhus represents but the inter-epidemic phase of the classical louse-borne disease. A necessary corollary of this is, of course, that *R. muricola*, the organism responsible for murine typhus, is capable of mutation into *R. prowazeki*, the cause of epidemic typhus; or, alternatively, that these two Rickettsiae are identical. There are serious difficulties in the acceptance of either of these hypotheses.

The chapter dealing with louse control will, of course, be of special interest to military hygienists and administrators. The author, in his preface, acknowledges the help given him in the compilation of this section by Colonel D. T. Richardson, M.C., recently Professor of Hygiene at the R.A.M. College.

Professor Buxton makes a plea for intensive research in methods of

control and suggests that a full try-out of such vegetable insecticides as derris, already used against lice infesting cattle, may prove fruitful.

It is interesting to note that lice have been found infected with *Pasteurella pestis* during plague epidemics, and the suggestion is made that members of those tribes (i.e. in the Andes district) which habitually crush lice between their teeth, may become infected with plague in this way.

The book is clearly and concisely written and little of importance has been omitted. It should prove an important addition to our war-time medical library. S. S.

**AIDS TO MEDICAL DIAGNOSIS.** Fifth Edition. By Arthur J. Whiting, M.D., M.R.C.P., and G. E. Frederick Sutton, M.C., M.D., B.S.Lond., M.R.C.P. London: Baillière, Tindall, and Cox. 1940. Pp. viii + 294. Price 5s.

That this little book has reached five editions is proof that it supplies a want.

The section on Diseases of the Heart has been extended and a useful series of electrocardiographic illustrations introduced.

Such few tropical diseases as are mentioned are dismissed in a few words. It is suggested that in view of the ever-increasing importance and range of these diseases this section might, with advantage, be considerably expanded in future editions.

A useful little *aide-mémoire* for the student and busy practitioner.

S. S.

**AIDS TO PSYCHIATRY.** By W. S. Dawson, M.A., M.D.Oxon., F.R.C.P.Lond., F.R.A.C.P., D.P.M. London: Baillière, Tindall, and Cox. 1940. Pp. vii + 320. Price 4s. 6d.

This is one of the Students' Aid Series "specially designed to assist students in grouping and committing to memory the subjects on which they are to be examined." It is also a clearly written, admirably condensed, and very sound exposition of its subject. The author is careful to indicate Freudian psychology as such and to suggest alternative explanations when these appear the more reasonable. The treatment advocated is invariably sound and both "shock" treatment and narcosis therapy are mentioned. It is beyond the scope of this volume to go into details of these methods.

This is a very useful book for the average medical officer or general practitioner whose knowledge of psychiatry is apt to become rusty. It would be a useful addition to every military medical library.

G. W. W.

**MODERN TREATMENT IN GENERAL PRACTICE. YEAR BOOK 1940.** By Numerous Authors. Edited by Cecil P. G. Wakeley, D.Sc., F.R.C.S., etc. London: The Medical Press and Circular. 1940. Pp. xiv + 312. Price 12s. 6d.

This year's edition of "Modern Treatment" is well up to standard. As a

“link between specialized and general knowledge” this type of book fulfils a most useful purpose, and is sure of a ready sale.

The article by Colonel Mitchiner on the Treatment of Burns in War should make a special appeal to medical officers at the present time. The book is real value for 12s. 6d., and it would be a pity to spoil the anticipation which the prospective purchaser will feel by mentioning more of the contents.

D. C. M.

TEXTBOOK OF PUBLIC HEALTH. Tenth Edition. By W. F. Frazer and C. O. Stallybrass. Edinburgh: E. and S. Livingstone. 1940. Pp. x + 504. Price 21s. net.

The many and great changes and advances in public health work have necessitated an enlargement of the present edition of this book from 340 to over 500 pages.

Some fifteen chapters are new and have been completely rewritten, particularly those in connexion with tuberculosis, smoke abatement, genetics, hospital administration, and the medical aspects of civil defence.

Legislation is considered in relation to the various subjects to which it refers in the chapters devoted to them, and has been dealt with by the authors clearly and simply. It is suggested, however, that the information given in this particular connexion is at times somewhat meagre.

The Vaccination Acts, for instance, receive scant attention, and information in regard to them occupies only seventeen lines. In certain other cases also, legislation is not discussed in quite sufficient detail.

The statement, too, in the preface that the work covers fully the requirements of examining bodies for the D.P.H. is a little exaggerated. It may be true as regards some examining bodies but certainly not as regards all, and no single book that has been written up to date can lay claim with any degree of veracity to such an enviable distinction.

In general the authors have dealt with their subject in an eminently practical manner. Their book gives much information which is up to date and of value to those studying for the D.P.H. or otherwise interested in public health matters, and should form a useful addition to their armamentarium.

PSYCHOLOGY AND PSYCHOTHERAPY. Fourth Edition. By William Brown, D.M., F.R.C.P. London: Edward Arnold and Co. 1940. Pp. viii + 260. Price 12s. 6d.

That this book is now in its fourth edition is some indication of its value to, and appreciation by, practising psychotherapists.

Dr. Brown I remember as a kindly and lucid lecturer whose views were sound and whose teaching was practical. In this book much of the man is revealed. It is, perhaps, unfortunate that so much of it is too technical to be followed easily by those lacking special training in modern psychological methods.

The chapters dealing with the psycho-neuroses of war are of special interest and value. I would almost suggest that Chapters VII, IX (at least in part), XV, and Appendix I be read by all medical officers of the fighting Services.

Some may not agree with the prominence given to the theories of Freud, but the corrective opinions of William Macdougall and others are given due place.

There is one especially valuable piece of advice, on page 127 : " Let him pour out his heart. Let him talk himself out." This advice may well be followed with much benefit in troubles other than the one there under discussion. It was a method of treatment followed by many of us long before the advent of psycho-analysis, yet how similar it is.

I found this an enjoyable and stimulating book.

G. W. W.

LEPROSY. Second Edition. By Sir Leonard Rogers, K.C.S.I., C.I.E., M.D., F.R.S., and Ernest Muir, C.I.E., M.D. Bristol: John Wright and Sons, Ltd. 1940. Pp. xii + 260. Price 15s. net.

A second edition of this well-known standard work on leprosy by two of our great pioneers in this branch of medicine is more than welcome.

The authors in their preface mention that great progress has been made in our knowledge of leprosy since they wrote the first edition fifteen years ago, and we are their debtors for putting their pooled knowledge before us in such an interesting and convincing manner.

Leprosy stands pre-eminent amongst the many diseases that " cannot be learned from books," but with the aid of an excellent and well documented series of photographs and clear description, the authors have almost achieved the impossible.

To quote a few salient features :—

Great stress is laid throughout the book on the great and essential difference between the lepromatous and neural types of the disease, especially as regards their relative infectivity. The neural variety, although in the later stages often the most disfiguring and crippling of the two, is almost free from risk to others if, as is usually the case, the nasal mucosa is free from bacilli. The lepromatous cases, on the other hand, are often intensely infectious (if, indeed, this disease can ever be said to be *intensely* infectious) and should always be isolated from non-infected individuals until cured or free from infection.

Emphasis is also laid on the age period of maximum susceptibility, one half of a large series of cases being infected before 20 years of age and two-thirds under 25. Children who have lived in close contact with leprous parents or relatives rarely escape infection. On the other hand, the number of individuals infected by conjugal relationships appears to be relatively small. This, they argue, is due to the fact that when such relationships



commence the individuals are usually beyond the most susceptible age period of 0-20.

The two authors deal very fully with the epidemiology of the disease ; it is interesting and perhaps topical to mention that leprosy has been almost eradicated from Norway, where it was formerly a serious problem, as the result of an enlightened prophylactic and segregation policy, the latter partly on a voluntary basis.

In a book in which slips are few and far between I had the somewhat sardonic pleasure of hunting down one "entomological inexactitude." The correct label for the crab louse is, of course, *Phthirius pubis*, not *Pediculus pubis*. Nowadays, too, the head and body louse are recognized to be subspecies or races of one species, *Pediculus humanus*. These are, however, small blemishes in a book which does not set out to be a treatise on entomology.

The book was a joy to read and should prove of inestimable value to those whose daily task brings them in contact with lepers and leper problems.

S. S.

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## Notices.

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### AMINOPHYLLINE.

AMINOPHYLLINE, a combination of theophylline with ethylenediamine, is a recent addition to the range of products issued by Burroughs Wellcome and Co. This preparation is stated to possess the valuable therapeutic properties of theophylline with a considerably reduced tendency to produce gastric and renal irritation. The greater solubility conferred by the ethylenediamine component is believed to increase its rapidity of action and render it suitable for parenteral administration.

Aminophylline may be used as a general diuretic or a mild myocardial stimulant. Its effect in improving the blood supply of the kidney renders it valuable in relieving oedema in diseases of the kidney and heart.

### SONERYL.

THE demand for a Soneryl suppository of greater strength than the existing 3-grain product has led to the introduction of a new packing : 5 × 10-grain suppositories.

Soneryl has proved of outstanding value in conditions necessitating the administration of a hypnotic and sedative. In rapidity of action and of elimination it approaches the ideal qualifications required in a preparation of this nature. The packing of 5 × 3-grain suppositories is supplemented by the addition of the new pack referred to above.

Soneryl is also available in soluble form (soneryl sodium).

Pharmaceutical Specialities (May and Baker) Limited, Dagenham, will be glad to send full details of Soneryl, on request, to any member of the medical profession.

### HEXOBARBITONE.

WE are informed that hexobarbitone (N-methyl-*cyclohexenyl*-methylbarbituric acid) is now issued by Burroughs Wellcome and Co. as "Tabloid" Hexobarbitone and as the sodium salt Soluble Hexobarbitone, the latter for producing anæsthesia of short duration, for which it is injected intravenously. Soluble Hexobarbitone is of particular value in minor surgery, in simple tooth extractions, and to intensify gas-and-oxygen anæsthesia. It may also be used for the induction of general anæsthesia in operations of not more than twenty to thirty minutes' duration and, by rectal administration, to produce hypnosis and in the treatment of acute and chronic alcoholism. Soluble Hexobarbitone (Burroughs Wellcome and Co.) is issued in phials of 0.5 gramme and 1 gramme. Each phial is accompanied by a "hypoloid" ampoule containing sufficient sterile distilled water to prepare a 10 per cent solution of "Hypoloid" Soluble Hexobarbitone.

"Tabloid" Hexobarbitone, grains 4, is given orally to produce light hypnosis.

### PROSEPTASINE AND SOLUSEPTASINE.

#### FOR USE IN HÆMOLYTIC STREPTOCOCCAL INFECTIONS.

A NEW leaflet on Proseptasine and Soluseptasine has recently appeared, and a copy has been sent to us by the makers, Pharmaceutical Specialities (May and Baker) Limited, of Dagenham, Essex.

The low toxicity of Proseptasine, due to the introduction of the benzyl group into p-amino-benzenesulphonamide, has been demonstrated both in the laboratory and in clinical practice. This extra margin of safety has enabled Proseptasine to maintain its position as one of the best tolerated products for the treatment of hæmolytic streptococcal and other acute microbic infections.

Soluseptasine, for parenteral administration, is the only colourless sulphonamide available in concentrated aqueous solution. It is stated to be widely used in conjunction with Proseptasine for the treatment of erysipelas, puerperal sepsis, and septicæmia.

### RUTONAL.

A COPY of a new booklet on Rutonal has been sent to us by Pharmaceutical Specialities (May and Baker) Ltd., Dagenham, who are the makers of this drug.

Rutonal is stated to have the same general therapeutic uses as phenobarbital and is employed as an anti-convulsant, anti-spasmodic, and sedative in the treatment of epilepsy, *petit mal*, and other conditions in which central nervous system sedation is required. Compared with phenobarbital it has been found in clinical practice that, weight for weight, Rutonal has an activity in the order of about half that of phenobarbital, while it is less than

half as toxic. In the majority of patients Rutonal appears to be better tolerated than phenobarbital, being less liable to give rise to diurnal somnolence, lassitude, and mental depression.

#### “WELLCOME” BRAND BROMETHOL.

THE issue of “Wellcome” Brand Bromethol, by Burroughs Wellcome and Co., is considered to provide the medical profession with a valuable basal anæsthetic of British manufacture. “Wellcome” Bromethol is stated to be a 66.66 per cent w/w solution of tribromomethyl alcohol in amylene hydrate, and is administered *per rectum* in a 2½ per cent aqueous solution. The recommended dosage, calculated from the body-weight, produces a basal narcosis lasting about two hours.

Bromethol is used as a basal narcotic in general surgery, gynæcology, and obstetrics. It is well tolerated by children. It has also been used in the treatment of such conditions as chorea, angina, delirium, acute alcoholism, and the spasms of tetanus and of strychnine poisoning.

Before administration, it is desirable to use a test indicator, and “Wellcome” Congo Red Solution is issued for this purpose in bottles of 10 c.c. with pipette.

#### METHEDRINE.

METHEDRINE (*d*-methyloisomyn), the issue of which is announced by Burroughs Wellcome and Co., is a recently discovered synthetic compound belonging to the sympathomimetic amine group. Given orally, it is stated to produce a prolonged rise of blood-pressure and stimulation of the central nervous system, especially of the cerebral cortex. Methedrine is considered to be indicated in the treatment of narcolepsy; it may also be used in certain depressive psychopathic conditions, as an analeptic in barbiturate poisoning, and as an antispasmodic in the X-ray visualization of the gastrointestinal tract.

# JOURNAL OF THE ROYAL ARMY MEDICAL CORPS

## Corps News.

AUGUST, 1940.

### EXTRACTS FROM THE "LONDON GAZETTE."

*June 18.*—Lt.-Col. G. D. Jameson is placed in the h.p. list on account of ill-health. *June 19, 1940.*

*June 25.*—Col. R. J. Blackham, C.B., C.M.G., C.I.E., D.S.O. (14347), ret. pay (late R.A.M.C.), at his own request, relinquishes the rank of Col. whilst employed in the temp. rank of Maj. *May 30, 1940.*

*Short Service Commissions.*—The dates of ante-date and seniority of Lt. (temp. Maj.) P. R. Wheatley, M.B. (52033) are May 1, 1938 and May 1, 1939, respectively, and not as stated in the *Gazette* of June 7, 1940.

The appt. of Lt. J. S. F. Watson is ante-dated to May 16, 1938, under the provs. of Art. 39, Royal Warrant for Pay and Promotion, 1940, but not to carry pay and allces. prior to May 1, 1939.

Lt. J. S. F. Watson to be Capt. *May 1, 1940*, with seniority *May 16, 1939*. (Substituted for the notifi. in the *Gazette* of May 7, 1940.)

*June 28.*—Capt. D. P. F. Mulvany to be Maj. *June 29, 1940.*

*Short Service Commissions.*—The appt. of Lts. R. A. R. Topping and J. C. B. Nesfield are ante-dated to Dec. 22, 1938 and Jan. 20, 1939, respectively, under the provs. of Art. 39, Royal Warrant for Pay and Promotion, 1940, but not to carry pay and allces. prior to May 1, 1939.

The undermentioned Lts. to be Capts. :—  
R. A. R. Topping, *July 1, 1940*, with seniority *Dec. 22, 1938*.

J. C. B. Nesfield, *July 1, 1940*, with seniority *Jan. 20, 1940*.

E. P. Jowett, M.B., *July 3, 1940*, with seniority *Feb. 1, 1940* and precedence next below Capt. R. M. Hector, M.B.

*July 2.*—Lt.-Col. B. H. C. Lea-Wilson, having attained the age for retirement, retires *June 29, 1940*, and remains empld.

The undermentioned Maj. to be Lt.-Cols. :—

H. R. Sheppard. *June 19, 1940*.  
(Actg. Lt.-Col.) D. W. Beamish, M.C., *June 29, 1940*.

Maj. J. D. Corner, M.B. (31647) to take rank and precedence in his Corps and in the Army as if his promotion to Maj. bore date *Jan. 29, 1937*. (Substituted for notifi. in the *Gazette* of Apr. 16, 1940.)

*Short Service Commission.*—The appt. of Lt. E. H. Evans is ante-dated to Oct. 23, 1935, under the provs. of Art. 39, Royal Warrant for Pay and Promotion, 1940, but not to carry pay and allces. prior to Oct. 23, 1936.

Lt. E. H. Evans to be Capt., Oct. 23, 1937, with seniority Oct. 23, 1936, and precedence next below Capt. E. A. Smyth, M.B. (Substituted for the notifi. in the *Gazette* of Nov. 9, 1937.)

Lt.-Col. E. B. Lathbury, O.B.E. (8356), ret. pay (late R.A.M.C.), at his own request relinquishes the rank of Lt.-Col. whilst re-empld. in the temp. rank of Maj. *June 7, 1940*.

Maj. F. S. Irvine, C.M.G., D.S.O., M.B. (10434), ret. pay (late R.A.M.C.) is restd. to the rank of Col. on re-employment in that rank. *June 12, 1940*.

*July 5.*—Lt.-Col. H. N. Sealy, from R.A.M.C., to be Col. *July 10, 1940*, with seniority *Feb. 15, 1938*.

Maj. W. K. Campbell, D.S.O., M.B.E., M.C., M.B., to be Lt.-Col. *July 10, 1940*.

*Short Service Commission.*—The appt. of Lt. J. Mackay-Dick, M.B., M.R.C.P. Edin., is ante-dated to Oct. 1, 1937, under the provs. of Art. 39, Royal Warrant for Pay and Promotion, 1940, but not to carry pay and allces. prior to Oct. 1, 1938.

Lt. J. Mackay-Dick, M.B., M.R.C.P. Edin., to be Capt., Oct. 1, 1939, with seniority

Oct. 1, 1938. (Substituted for the notifn. in the *Gazette* of Oct. 3, 1939.)

Lt.-Col. L. G. Gibson, R.A.M.C. (8511) (ret. pay), at his own request, relinquishes the rank of Lt.-Col., whilst emplyd. in the temp. rank of Maj. June 5, 1940.

July 12.—Col. P. S. Tomlinson, D.S.O., M.R.C.P., late R.A.M.C., to be Dir., Med. Servs., and is granted actg. rank of Maj.-Gen. Apr. 4, 1940.

Capt. (temp. Maj.) C. S. Gross, M.B., F.R.C.S.Edin. (47492) to be Maj. July 11, 1940.

### Regular Army Reserve of Officers.

June 18.—Lt.-Col. T. B. Nicholls, M.B. (4398), having attained the age limit of liability to recall, ceases to belong to the Res. of Off. Mar. 13, 1940.

## TERRITORIAL ARMY.

June 18.—Lt. (Or.-Mr.) H. Hall (77359) relinquishes his commn. on account of ill-health. June 17, 1940.

June 25.—The KING has been graciously pleased to confer the Territorial Decoration upon the undermentioned Officer under the terms of the Royal Warrant dated Oct. 13, 1920 :—

Maj. Edwin Gaved Andrew, ret., late Royal Army Medical Corps (Territorial Army).

The KING has been graciously pleased to confer the Efficiency Decoration upon the undermentioned Officer under the terms of the Royal Warrant dated September 23, 1930 :—

Colonel William Albert Robertson, C.B.E., M.C., M.D. (7594).

Lt.-Col. E. R. Lovell, T.D., M.B. (26177), relinquishes his commn. on account of ill-health, and retains his rank with permission to wear the prescribed uniform. June 24, 1940.

Maj. F. Roberts, M.D., M.R.C.P. (87690), relinquishes his commn. on account of ill-

health, and is granted the rank of Capt. June 24, 1940.

June 28.—Capt. (Actg. Maj.) W. R. Nash (47331) relinquishes his commn. on account of ill-health, and retains his rank with permission to wear the prescribed uniform. Feb. 21, 1940. (Substituted for the notifn. in the *Gazette* (Supplement) dated Feb. 20, 1940.)

July 2.—Lt. D. Laing, M.B. (20443), from R. A. (T.A. Res. of Off.), to be Capt., June 10, 1940, with seniority Apr. 23, 1939.

July 9.—Capt. A. J. G. Newton, M.B. (41915), from R. Scots (T.A.R.O.), to be Capt. May 11, 1940 with seniority Feb. 17, 1940. (Substituted for the notifn. in the *Gazette* (Supplement) dated May 31, 1940.)

Lt. P. J. Helliwell, M.B. (93804) to be Capt. July 10, 1940 with seniority July 21, 1939, next below Capt. M. S. Pembrey.

July 12.—Lt. Col. E. D. Gray, M.D. (42427), resigns his commn. and retains his rank with permission to wear the prescribed uniform. Aug. 31, 1939. (Substituted for the notifn. in the *Gazette* (Supplement) dated Dec. 22, 1939.)

## THE ARMY DENTAL CORPS.

June 25.—*Short Service Commissions.*—The undermentioned Lts. (on prob.) are confirmed in their ranks :—

J. F. Russell (95469).

H. A. W. Lincoln (95470).

M. F. Porterfield (76055).

The undermentioned Lts. to be Cpts. June 26, 1940 :—

J. F. Russell (95469).

H. A. W. Lincoln (95470).

M. F. Porterfield (76055).

### Regular Army Reserve of Officers.

June 21.—Maj. N. H. Medhurst (14382) resigns his commn. June 22, 1940.

## QUEEN ALEXANDRA'S IMPERIAL MILITARY NURSING SERVICE.

June 18.—The undermentioned Sisters resign their appts. :—

Miss W. Clarke. June 5, 1940.

Miss N. W. Merriman. June 18, 1940.

June 21.—The undermentioned resign their appts. :—

Sister Miss F. O. Wilson. May 27, 1940.

Provl. Staff Nurse Miss N. V. Fitzgerald. May 14, 1940.

June 25.—Matron Miss A. D. M. Alban to be Principal Matron. Apr. 11, 1940.

Sister (temp. Matron) Miss R. G. Moffat, A.R.R.C., to be Matron. Apr. 11, 1940.

Sister Miss M. C. Rice resigns her appt. May 6, 1940.

The undermentioned Staff Nurses to be Sisters :—

May 15, 1940 :—

Miss M. Clark.  
Miss E. M. Sanders.

May 20, 1940 :—

Miss E. M. C. Rowston.

June 1, 1940 :—

Miss K. D. B. Wells.  
Miss H. P. K. Brett.  
Miss F. L. Purchase.

The undermentioned provl. Staff Nurses are confirmed in their appts. :—

Miss M. J. Baird.  
Miss E. M. Lloyd.  
Miss K. L. Brewin.  
Miss J. S. Brooks.  
Miss J. C. J. Keir.  
Miss I. E. Paddon.  
Miss V. Kelly.

July 5.—Matron Miss J. F. Watson, retires on ret. pay on account of ill-health, July 6, 1940.

July 12.—Sister Miss C. A. M. Cook resigns her appt., July 1, 1940.

The undermentioned Staff Nurses to be Sisters :—

Miss M. Ryan, Jan. 7, 1940.  
Miss E. A. O'Carroll, June 5, 1940.  
Miss G. C. M. Hill, June 7, 1940.  
Miss E. Conner, June 19, 1940.

The undermentioned Staff Nurses are confirmed in their appts. :—

Miss E. M. Stonham.  
Miss A. M. Heywood.  
Miss M. E. Leitch.  
Miss M. Hellen.  
Miss F. U. Hedge.  
Miss E. M. Spreckley.  
Miss A. M. R. Trevelyan.  
Miss M. Caudwell.  
Miss J. Marchant.

### AWARDS BY THE C.-IN-C., B.E.F.

#### AWARDED THE DISTINGUISHED SERVICE ORDER.

Newman, Lt. (t/Maj.) P. H., F.R.C.S., R.A.M.C.

This officer was responsible for the surgical work in the C.C.S. : at Bethune he organized three twin table operation theatres, and later at Rosendael, Dunkirk, such surgical work that could be undertaken with reduced equipment. His unremitting keenness, hard work, and skill as a surgeon were a source of inspiration to all employed in the surgical division, and were the means of saving many lives and of giving the best possible treatment under most exacting conditions to several hundred badly wounded officers and men. This officer cheerfully accepted the ballot whereby he was left in charge of wounded that could not be evacuated.

Goodridge, Lieutenant (Qr.-Mr.) Edwin, R.A.M.C.

He showed a most outstanding personality throughout the operations and inspired his unit. After the field ambulance had received severe casualties, losing its commanding officer, second in command, and regimental serjeant-major, it continued its full duties, due largely to Lieutenant Goodridge's unrelenting efforts. Finally, though wounded himself, he conducted an ambulance loaded with wounded officers through heavy fire to the beaches at Dunkirk.

#### AWARDED THE MILITARY CROSS.

Capt. P. K. Jenkins, R.A.M.C.

He established an advanced dressing station at Bray Dunes on May 29, which he kept functioning with practically no staff until June 1.

Lt. (a Capt.) J. Reynolds, R.A.M.C.

When the enemy shelled the Mole at Dunkirk on which were concentration of British and French troops, Captain Reynolds obtained carrying parties to move the wounded

and accompanied them to the advance dressing station, where he worked all through the day. He saved many lives and showed a complete disregard for his own safety.

Stevens, Lieut. A. V., R.A.M.C.

On May 28 Lieutenant Stevens was sent back with a convoy of wounded from Mont des Cats to an advanced dressing station near Poperinge. On arrival, he found it practically destroyed by air bombing. He collected more wounded from the ruins and took his convoy to Dunkirk. After embarking his casualties and attending to further casualties on the beach, he returned with more medical supplies to Mont des Cats. On his arrival he found that his Division had retired and the position was being heavily shelled, the woods and buildings being on fire. He found an undamaged vehicle and succeeded in bringing out a number of wounded who had been left in a monastery that had since caught fire.

On his way back to Dunkirk he collected into his convoy other ambulances which had lost their way. The convoy was attacked by enemy tanks, and the majority of the ambulances destroyed and the wounded killed. The tanks were in turn surprised and destroyed by our artillery. Lieutenant Stevens thereupon collected what men remained alive into the only remaining ambulance and brought them to Dunkirk. By his persistent courage, endurance, and resource, this officer saved very many lives.

#### AWARDED THE MILITARY MEDAL.

Hudson, Corporal W., R.A.M.C.

Throughout the operations he attended the wounded under bomb and shell-fire with a total disregard to his own safety, although casualties in the unit were severe. He was an inspiration to his unit. Later his work at Dunkirk and in the hospital ship and train showed the same devotion to duty.

### THE KING'S BIRTHDAY HONOURS LIST.

The following awards were included in the King's Birthday Honours List published in the *London Gazette* :—

C.B.E. :	Col. Gordon Wilson, O.B.E., M.C., M.B., late R.A.M.C.	Lt. (Act. Maj.) H. Allan, M.D., R.A.M.C.
	Miss C. M. Roy, R.R.C., M.M., Matron in Chief Q.A.I.M.N.S.	Lt. G. D. Macintosh, R.A.M.C.
O.B.E. :	Lt.-Col. E. W. Wade, D.S.O., M.D., R.A.M.C.	Lt. F. M. Smith, R.A.M.C.
	Lt.-Col. H. Walker, M.C., R.A.M.C.	Lt. (temp. Capt.) M. J. Lindsay, R.A.M.C., T.A.
M.B.E. :	Lt. (Act. Maj.) E. Gillett, R.A.M.C.	Capt. J. R. Heslop, R.A.M.C., T.A.
	Lt. (Q.M.) J. W. Price, R.A.M.C.	Lt. (Act. Maj.) C. W. Simpson, R.A.M.C., R.A.R.O.
	W.O. Cl. 1 D. E. Dean, M.C. (late R.A.M.C.).	R.R.C. Miss Cecilia Pyke, Matron, 1st Cl. Q.A.I.M.N.S.
	Miss E. G. Reynolds, Sister Q.A.I.M.N.S.	R.R.C. Miss Alice Gertrude Murrie, Sister, 2nd Cl. Q.A.I.M.N.S.
M.C. :	Capt. (Act. Maj.) W. M. Arnott, R.A.M.C., T.A.	Miss Jane Amelia Patterson, Sister, Q.A.I.M.N.S.
	Capt. (Act. Maj.) N. Pyecroft, M.B., R.A.M.C., T.A.	Miss Helen Fleming McFeat, Sister, Q.A.I.M.N.S.
		D.C.M. : Staff Sjt. F. Frankish, R.A.M.C.
		M.M. : Lce-Cpl. H. J. Young, R.A.M.C.
		Sjt. T. Cowan, R.A.M.C.

### THE BRITISH RED CROSS SOCIETY PRISONERS' PARCELS CENTRE.

The Corps has given £200 to this centre.

### ROYAL ARMY MEDICAL CORPS OFFICERS' BENEVOLENT SOCIETY.

PROCEEDINGS of the Annual General Meeting of the R.A.M.C. Officers' Benevolent Society held at the R.A.M.C. Headquarter Mess, Millbank, S.W.1, on Monday, June 3, 1940. Lieut.-Gen. Sir Harold B. Fawcus, K.C.B., C.M.G., D.S.O., in the Chair.

The Minutes of the 1939 Annual General Meeting were read and confirmed.

The Reports and Accounts for the year 1939 were adopted.

Grants as recommended by the Committee amounting to £1,002 on behalf of 42 orphans were approved.

Maj.-Gen. R. S. Hannay, C.B., C.M.G., D.S.O. ; Maj.-Gen. O. L. Robinson, C.B., C.M.G. ; and Maj.-Gen. T. S. Coates, C.B., C.B.E., were elected Vice-Presidents for the year.

Colonel F. S. Irvine was elected Member of the Committee vice Lieut.-Colonel J. S. K. Boyd due to retire, and also Maj.-Gen. F. D. G. Howell, C.B., D.S.O., M.C., K.H.S., who was willing to continue to serve.

Messrs. Evans Peirson and Co. were appointed auditors for the ensuing year.

The meeting terminated with a vote of thanks to the Chairman.

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### ROYAL ARMY MEDICAL CORPS FUND.

PROCEEDINGS of the thirty-eighth Annual General Meeting of the Royal Army Medical Corps Fund held at the R.A.M.C. Headquarter Mess, Millbank, on June 3, 1940. Lieut.-Gen. Sir Harold B. Fawcus, K.C.B., C.M.G., D.S.O., Representative Colonel Commandant, R.A.M.C., in the Chair.

Col. L. M. Purser, D.S.O., and Col. P. Evans, C.M.G., regretted their inability to be present.

The Minutes of the 37th Annual General Meeting were read and confirmed.

The Report and Accounts for the year 1939 were adopted.

A grant of £25 to the General Relief Branch from the Officers' Branch was approved.

A grant of £300 to the R.A.M.C. Band Fund was approved.

Messrs. Evans Peirson and Co. were appointed auditors for the ensuing year.

Grants from the R.A.M.C. (Aldershot) School Fund amounting to £122 16s. were approved.

On the proposal of Major-Gen. Brooke Purdon, seconded by Col. O'Riordan, Col. F. S. Irvine, C.M.G., D.S.O., was elected as a member to the Committee vice Maj.-Gen. J. F. Martin, C.B., C.M.G., due to retire under Rule 111, 2.

There being no further business the meeting terminated.

PROCEEDINGS of a Meeting of the Committee of the Royal Army Medical Corps Fund held July 3, 1940.

(1) *Officers' Branch*.—A grant of £200 to the British Red Cross Society Prisoners' Parcels Centre was sanctioned.

(2) *General Relief Branch*.—(i) The following donations were received : R.A.M.C. Association, Singapore, £5 5s. ; R.A.M.C. Depot, £50 ; No. 9 Coy. Colchester, £5 ; No. 20 Coy. Tidworth, £4 ; Army School of Hygiene, £5 ; No. 29 Coy. Jamaica, £3. Total £72 5s.

(ii) Grants amounting to £63 15s. made by the Secretary during the quarter were approved.

## THE BAND OF THE ROYAL ARMY MEDICAL CORPS.

SINCE the outbreak of the war, the R.A.M.C. Band has come so much into the public eye throughout the Command that we feel that readers of the Corps Journal might like to know something of its activities.

It may be of interest to give a short account of its history. The earliest records show that the Band was formed in 1896 as a military band and orchestra, the nucleus of which was a small band then in existence at Netley. The first Bandmaster was Mr. Bennett. Other Bandmasters to follow were Mr. Robertson, Mr. Bradley, Mr. Lane, and Mr. Loftus. The last Bandmaster of the old "unofficial" Corps Band was Mr. Carotti, who retired in January, 1939. From that date the Band has been recognized as an official Staff Band, and Bandmaster H. Johnson, A.R.C.M., who was then Bandmaster to the North Staffordshire Regiment, was appointed to the Royal Army Medical Corps Band by Kneller Hall. Any account of the Band would be incomplete without the name of Col. Wallace Benson, C.B.E., D.S.O., who did so much to raise the standard of performance of the Band during the years that he was Band President. It was he who introduced the present Corps March, "Bonnie Nell," in 1926 in place of "Her Bright Eyes Haunt Me Still." The latter march is, however, still used at the Depot to march the companies on to the Parade Ground before Commanding Officer's inspection, and "Bonnie Nell" is, of course, played for the march past.

Most readers of the JOURNAL will remember the Band as it was in time of peace. What Corps function was complete without it? The band played at the annual sports meeting at Aldershot, the Corps swimming gala, Netley week—when the band played morning, afternoon, and evening to the officers, nurses, troops, and patients; the officers' annual dinner at the Trocadero; the sergeants and W.O.s annual dinner at the Princes; guest nights at officers' messes at Crookham, Aldershot, Millbank, Woolwich, Tidworth, Netley, and Catterick; the nurses' annual at home at the Dorchester Hotel; and numerous other functions.

Since the war, the work of the band has greatly increased. They were, together with other staff bands in the Command, kept at home to entertain the troops.

They started by giving concerts to the reservists and militia in the Old Depot Concert Hall under most difficult conditions. Immediately these concerts proved not only popular but necessary. The concerts given were of the stage band type with talent from the troops, and excellent talent was soon discovered.

During the first month of the war the band enlisted many first-class musicians from famous dance bands, the B.B.C., and well-known orchestras. This of course gave them the chance to improve the style and efficiency of the concerts. It meant hard work from everybody to put on a different show each week, and improve the standard set by the previous show. Certain members of the band worked throughout their off-duty hours to arrange special concert versions of the most popular numbers, and others worked on script for novelty items and sketches.

It soon became apparent that ours was no ordinary band. Not only could they put on a first-class stage band, but also supply the vocal and novelty items from their own personnel assisted by a few discoveries passing through the Depot, and one or two members of the A.T.S. who have given valuable assistance.

The Depot moved to Boyce Barracks, and a gymnasium was used as a temporary theatre until the Garrison theatre was completed. From then onwards the troops proved that the weekly band concert was certainly something to which to look forward. They turned up in hundreds an hour before the show started, and although we could accommodate about 1,200, many were unable to get a seat.

The Commandant, Col. W. H. O'Riordan, M.C., then decided that the show was too good to keep to ourselves, and invited Lt.-Col. Newington, M.V.O., Command Welfare Officer, to see it, and the Welfare Officer of the Canadian Division. They immediately recognized its entertainment value and approached E.N.S.A. on the subject of band concerts throughout the



Command. Plans were soon worked out, and in a fortnight the band was fitted out with suitable stage dress and commenced to play every Sunday at the Garrison theatre in the Command. The Corps band proved an immediate success, for when Sir Harry Lauder came to Aldershot with his company for a week, the R.A.M.C. Band was chosen to play with them.

Apart from variety shows, straight orchestral concerts were given by request, and it was surprising to find how many of the men were musically minded.

When the B.E.F. returned, the demand for musical entertainment was heavy, and the band went out with all their kit to entertain the troops in the various reception camps. It would be difficult to describe the reception given to the band by these men. Mr. Anthony Eden arrived during one of these informal shows and was agreeably surprised.

Each contingent of Canadian troops was met by the band, and marched to the barracks allotted to them. A letter of thanks has been received from the G.O.C., Canadian Division. This meant meeting many trains at a few hours' notice. All our own troops were pleased to have the band march them away and give them a few tunes at the station, then rolling away to the strains of "Bonnie Nell."

Apart from the weekly concerts the band is now playing two evenings a week in the open, and on Sunday mornings after church parades. When available, they have also played in church for the evening service as well as the morning service, and Sunday evening concerts were given in the sergeants' mess. Periodical programmes are also played in the grounds of the officers' mess.

The dance band has also been very popular at many functions and is a great feature at the officers' club.

The band is frequently called upon to play the Salute when Royalty or other distinguished visitors inspect the troops in the Command. A new departure is that of enlisting band boys into the Corps. There are now seven boys being trained as musicians and we hope for more as these boys will form the nucleus of the post-war band.

The band is now working harder than it has ever worked, and it can fairly be said that the standard of music is as high as it has ever been.

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## KILLED IN ACTION.

TEMPORARY MAJOR (CAPTAIN) JOHN NOEL CONCANNON, in Belgium, in June, 1940. He was born in St. Vincent, British West Indies, on Dec. 25, 1910, received his medical education at Trinity College, Dublin, and joined the R.A.M.C. as Lieutenant, Feb. 27, 1933. Promoted Captain May 1, 1934, he was appointed Adjutant 49 (West Riding) Division T.A. June 1, 1939.

CAPTAIN JAMES MORRISSEY, R.A.M.C., who is reported to have been killed in action in France, was in practice at Bradford. He obtained his M.B. at Liverpool in 1925 and was honorary surgeon to the Bradford Special Constabulary. He held a commission in the

R.A.M.C., Territorial Army. He leaves a widow.

LIEUTENANT AUGUSTUS WILLIAM CARBONI. Born on Feb. 1, 1915, he graduated last year M.B. of the National University of Ireland, and was gazetted to an Emergency Commission in the R.A.M.C. as Lieutenant as recently as March 11, 1940.

LIEUTENANT IVOR REES DAVIES, M.B., B.S.Lond., R.A.M.C., who has been killed on active service, was 25 years of age. He was the eldest son of Dr. and Mrs. H. R. Davies, of Bedford Lodge, Whyteleafe, Surrey.

---

## DEATHS.

WRIGHT MITCHELL—At Pendyffryn Hall, Penmaenmawr, on June 21, 1940, Colonel Wright Mitchell, O.B.E., aged 58.

CARMICHAEL. — In Putney, suddenly, on June 19, 1940, Lieutenant-Colonel Donald Gordon Carmichael. Born Oct. 28, 1876, he was educated at Edinburgh University, where he graduated M.B. in 1902. Entering the R.A.M.C. on January 31, 1903, he was promoted Major on Oct. 31, 1914 and retired with the rank of Lieutenant Colonel on December 29, 1923. A Specialist in the Diseases of Women and Children, he

contributed articles to the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS and was a member of the S.W. London Medical Society. He served in the third Afghan War, being awarded the Medal with Clasp. He was also in possession of the British War Medal.

PROBYN.—In Hampstead on June 27, 1940, Lieutenant-Colonel Percy John Probyn, D.S.O. Born November 11, 1867, he was M.B.Lond., D.P.H., R.C.P.S., and a Barrister-at-Law. Entering the Service as a Surgeon Lieutenant on January 29,

1896, he was promoted Lieutenant Colonel March 1, 1915, and retired December 4, 1920. He was a Member of the Pensions Appeal Tribunal, Lecturer on Health, Monmouth County Council, and Reader in Hygiene and Sanitary Law, London College Incorporated Estate Practitioners. He served with the Lagos Expeditionary Force 1897-98, being awarded the Medal and Clasp; and the Sierra Leone Expedition, 1898, being awarded a Clasp. In the South African Campaign he took part in the advance on Kimberley including the action at Magersfontein; the relief of Kimberley; operations at Paardeberg; actions at Poplar Grove, Dreifontein, Vet River, and Zand River; actions near Johannesburg, Pretoria, and Diamond Hill; operations on the Zululand frontier of Natal, September and October, 1901. He was mentioned in despatches *L.G.* February 8, 1901, and was awarded the D.S.O., Queen's Medal with four Clasps, and the King's Medal with two Clasps. In the Great War he served in France in 1914 and 1915 and with the Egyptian Expeditionary Force in 1917 and 1918, being awarded the 1914 Star, British War, and Victory Medals.

ORR.—At Llandudno, on June 29, 1940, Major Wilfred Burnet Faris Orr. Born May 24, 1899, he graduated M.B.Belf. in 1921 and took the D.P.H. in 1928. Commissioned as Lieutenant, R.A.M.C., August 1, 1923, he was promoted Captain, February 1, 1927 and Major, May 1, 1934. He won the Leishman Silver Medal and Parkes Memorial Bronze Medal in 1931. In the present war he served in France and Belgium from September 4, 1939, till February 22, 1940, and from April 1, 1940, till May 30, 1940.

ECCOTT.—On July 2, 1940, Major Walter Yardley Eccott. Born September 3, 1896, he graduated M.B.Edin., in 1918. Gazetted Lieutenant, R.A.M.C.S.R., March 20, 1919, and mobilized the same day, he joined the R.A.M.C. as Lieutenant and temporary Captain June 1, 1920, and was promoted Captain, September 20, 1922, and Major, March 20, 1931. He had two periods of half pay owing to ill-health, May 5, 1922 to November 23, 1922, and from March 30, 1938 till his death. He was Divisional Adjutant 48 (South Midland) Division, T.A., from December 28, 1928, to January 31, 1932. He served in Iraq 1919-20, being awarded the Medal and Clasp.

## EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

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### CONTENTS

ORIGINAL COMMUNICATIONS.	PAGE	CLINICAL AND OTHER NOTES.	PAGE
Analysis of Knee-joint Operations. By Colonel N. CANTLIE, <i>M.C., F.R.C.S.</i> . . . . .	141	Notes on an Interesting Case. By Captain J. MACKAY-DICK, <i>M.B., Ch.B., M.R.C.P.(Edin.), R.A.M.C.</i> . . . . .	182
Practical Hints on the Treatment of War Injuries in Forward Areas. By Lieutenant-Colonel R. R. G. ATKINS, <i>M.C., R.A.M.C.</i> . . . . .	152	Road Movement by Field Ambulance on Convoy. By Major R. A. STEPHEN, <i>R.A.M.C.</i> . . . . .	189
Modification of the Regulation Army Steel Helmet and Boots. By K. VERNON BAILEY, <i>M.C., M.D., M.R.C.P., F.R.C.O.G., late Captain R.A.M.C.</i> . . . . .	160	ECHOES OF THE PAST. Notes on the Medical Services during the Civil War and the Interregnum, 1642-1660. By the late Lieutenant- Colonel G. A. KEMPTHORNE, <i>D.S.O., R.A.M.C. (R.P.)</i> . . . . .	192
Memorandum Concerning the Use of Sulphonamide Derivatives . . . . .	172	CURRENT LITERATURE . . . . .	202
EDITORIAL.		REVIEWS . . . . .	204
Food . . . . .	178	CORRESPONDENCE . . . . .	209
		NOTICES . . . . .	210

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AN ANALYSIS OF KNEE-JOINT OPERATIONS.

BY COLONEL N. CANTLIE, M.C., F.R.C.S.

(Continued from p. 77.)

*Special Operative Procedures.*

Different operations have been described for affording more extensive exposure of the knee-joint. These include :—

(a) An incision commencing over the centre of the quadriceps in the thigh, skirting the patella on the inner side and ending over the tibial spine. The patella is dislocated to the outer side after the expansion of the quadriceps into the patella has been cut. I tried this incision and was disappointed in the exposure obtained. In my opinion it is not to be recommended.

(b) Splitting the patella vertically.

(c) Splitting the patella in a coronal plane leaving the patella ligament attached to the lower fragment. Then turning the two halves upwards and downwards.

Both (b) and (c) would give a good exposure, but there is the difficulty of treating a divided patella after dealing with the knee. This leads one to wonder whether it might not be better to excise the patella in such cases, and logically there appears to be no reason why this should not be done.

*Regrowth of a Semilunar.*

Cases have been reported where the semilunar cartilage has been found present at a second operation, after being excised previously. I had one such case in my series. The man had had his internal semilunar cartilage removed at Woolwich several years before, and when I operated I again



removed a fractured internal semilunar. It has been proved that the reformed semilunar cartilage is composed, not of cartilage, but of fibrous tissue.

#### LESIONS PRESENT IN 100 KNEE-JOINT OPERATIONS.

Type of lesion	Number and percentage
Fracture internal semilunar cartilage .. .. .	76
Fracture external semilunar cartilage .. .. .	13
Osteochondritis .. .. .	8
Hypertrophy of infrapatellar pad of fat .. .. .	2
Loose bodies .. .. .	1
	<hr/>
	100

#### TYPES IN 80 CASES OF SEMILUNAR FRACTURE.

Fracture	Number	Percentage
Longitudinal or bucket-handle fracture ..	42	53
Anterior fracture .. .. .	20	25
Posterior fracture .. .. .	13	16
Loose semilunar—no fracture found .. ..	5	6
	<hr/>	<hr/>
	80	100

These approximate to Bristow's figures given previously, with the exception of fractures of the posterior portion of the cartilage. It is certain that four out of the five cases classified as "Loose—no fracture found" were faulty diagnoses. These cases should be included under posterior fractures. This would bring the percentage up to 21.

#### RESULTS OF 83 CASES OF ALL TYPES OF KNEE-JOINT OPERATION.

	Number	Percentage
Very good .. .. .	52	63
Good .. .. .	15	18
Fair or poor, to be counted as failures ..	16	19
	<hr/>	<hr/>
	83	100

The standard adopted for assessing results was as follows :—

*Very Good.*—Patients who were able to play football, etc., and do full military duty.

*Good.*—Patients who stated the knee was improved following operation. could do full military duty, but were either unable to play football at all or were unable to play with comfort.

*Fair or Poor.*—Patients who stated the knee was not improved by operation and were unable to play games. Six cases out of the total of sixteen in this class were able to do full military duty. The total following operation who were unable to do full military duty was 10 or 12·5 per cent.

The diagnoses of the 16 cases of failure were as follows :—

- Case 1. Osteochondritis and many loose bodies.
- Case 2. Osteochondritis and loose body.
- Case 3. Nipping of intrapatellar pad of fat.
- Case 4. Fracture internal semilunar cartilage.
- Case 5. Loose internal semilunar cartilage.
- Cases 6 & 7. Fracture dislocation internal semilunar cartilage associated with osteochondritis which was only discovered at a second operation.
- Case 8. Hypertrophy intrapatellar pad of fat.
- Case 9. Fracture internal semilunar cartilage.
- Case 10. Loose internal semilunar cartilage.
- Case 11. Loose internal semilunar cartilage.
- Case 12. Loose internal semilunar cartilage.
- Case 13. Fracture dislocation external semilunar cartilage.
- Case 14. Fracture internal semilunar cartilage.
- Case 15. Old fracture internal semilunar cartilage.
- Case 16. Fracture dislocation external semilunar cartilage.

How can these cases of failure be accounted for, and what lessons can be learned in order to avoid such results ?

The failures should be grouped under three headings :—

- (1) Faulty diagnoses.
- (2) Faulty operative technique.
- (3) Faulty post-operative treatment.

These will be discussed in order.

#### (1) *Faulty Diagnoses.*

Under this heading are included :—

(a) Cases 3 and 8 : The nipping or hypertrophy of the intrapatellar pad of fat was secondary to a more severe injury. There is no doubt these two cases had some kind of semilunar fracture or osteochondritis which was missed on exploring the joint.

(b) Cases 5, 10, 11, 12 : The four loose semilunar cartilages are also not "honest to goodness" diagnoses. These failures are certainly due to a fracture of the posterior portion of the semilunar being missed. It is an added and important argument for the removal of the whole semilunar at operation. Nothing could be more useless than removing a "loose" anterior portion of cartilage and leaving the real cause of the trouble behind. Once the diagnosis has been made of a fractured semilunar and a normal though so-called "loose" cartilage is found on opening the joint, it should be a rule that the posterior part of the cartilage must be removed, otherwise the operation may be a failure. Obvious though it appears, it was some time before I learned this lesson. My earlier timidity in dealing with the

knee-joint was overcome when a suitable posterior incision showed that the removal of the posterior third of the cartilage was not a difficult proposition.

### (2) *Faulty Operative Technique.*

(a) Cases 4, 9, 13, 14, 16: These cases all had definite visible fractures of the semilunar cartilage, and the failure of recovery must be put down to faulty operative technique. Only the visible fractured portion of the semilunar was removed at operation. Failure was due to leaving the posterior portion of the semilunar behind. This posterior portion is often dragged on and loosened when the anterior portion is removed, and a loosened semilunar in such a position will cause symptoms. I was able to do a second operation on only one of these cases, as the others had gone to other stations. This case was cured by the removal of the posterior portion of the cartilage through a posterior incision. I have not the slightest doubt that the other cases could be cured by this procedure.

(b) Case 15: This was a pensioner who had been drawing a disability pension for semilunar cartilage injury after an operation for removal. He was very unwilling to undergo further operation, but finally consented, and I removed the posterior portion of the semilunar which had been left behind. He reported he was no better after operation, but I believe the pension which he was likely to lose influenced his reply.

### (3) *Faulty Post-operative Treatment.*

Cases 1, 2, 6, and 7: These were all cases of osteochondritis which failed to respond to treatment. Most cases of this nature can be cured by prolonged immobilization in plaster of Paris. The average period these cases were treated was six weeks, which was not long enough. Some cases would probably require three months or more.

## OSTEOCHONDRITIS.

The description "osteochondritis" in the class of case referred to here is really a misnomer, for rarely is there evidence of any inflammatory process.

The condition is caused by injury, direct or indirect, to the articular cartilage of the femur or tibia, and may be associated with an injury to the semilunar cartilage. The area affected is frequently in the neighbourhood of the intercondyloid notch.

(a) *Direct Injury.*—This usually affects the articular cartilage of the femoral condyles, and is sometimes caused by a kick on the condyles of the femur when the knee is in acute flexion. It will be evident that the articular cartilage of the tibia is rarely injured in this way.

(b) *Indirect Injury.*—This injury is caused by a violent impact transmitted to the articular surfaces of the joint through the foot. It is usually due to jumping down from a height.

*Pathology.*—The injury causes a split in the articular cartilage which

may be linear or stellate. The extent varies and depends on the force of the injury. The condyle may show a variety of features : (a) A linear split about 1 inch long with loosened cartilage on each side ; (b) an area denuded of cartilage and revealing bare bone, with loose undermined cartilage radiating from the injured area ; (c) Constant movement may cause irritation at the affected site and this may lead to proliferation of cartilage in the form of villous-like processes ; (d) The injured area may show a clean healed surface, but with a large loose body which was detached at the time of the original injury lying free in the joint.

The constant movement of the joint prevents any chance of repair in the split cartilage and leads to a slow erosion of the cartilage on each side of the damaged area. As the erosion proceeds, small blood-vessels are opened up which bleed, and the presence of blood-stained synovial fluid is characteristic of the condition. The eroded cartilage is shed off into the joint in the form of numerous small flakes, which gradually increase in size until one may be sufficiently large to cause locking of the joint. In the course of time an osteoarthritis of the joint supervenes.

*Symptoms and Physical Signs.*—The symptoms are those of an internal derangement of the joint and are difficult to distinguish from those of a fracture of the semilunar cartilage, a condition with which it may be associated. There may be more grating on movement than one would get with a semilunar injury, and the presence of a loose body may cause one to suspect the condition.

At operation the presence of a blood-stained synovial fluid, and small loose flakes of cartilage are very significant, and when these features are present, I always make a point of inspecting the surface of the femoral condyle.

*Case 1.*—History : Football injury ; knocked over by a charge and felt pain at the back and outer side of the left knee. No locking. Synovitis for fourteen days. Knee has never been right since. When walking ten days ago, knee “ went out.”

Diagnosis : Fracture of external semilunar cartilage.

Operation : External cartilage exposed and appeared normal, but on flexing the knee, an area of old osteochondritis appeared over the external condyle of the femur. This area now appeared to have resolved, but a piece of articular cartilage was missing. On syringing out the joint a loose body, corresponding in size to the area over the condyle, was extruded. It was hoped this loose body was the cause of the knee “ giving out.” A report, received after the patient had become a reservist, stated that the knee was no better. The probable explanation is, that there was a fracture of the posterior portion of the external semilunar cartilage which occurred at the same time as the injury to the external condyle.

*Case 2.*—History : Not available.

Operation : Internal semilunar cartilage was found fractured and was removed. A piece of cartilage, the size of a sixpence, was found partially

separated from the internal condyle of the femur. This was excised and the knee put in plaster of Paris for two months.

A report one year later stated that the man is quite fit. He is not a footballer but can march thirty miles.

*Case 3.*—History : Slipped in barrack room and leg went outwards with severe pain ; knee locked. Synovitis for one month and at intervals since.

Examination : Pain over anterior end of the internal semilunar cartilage and over the external condyle when bending the knee.

Diagnosis : Fracture of internal semilunar cartilage. X-ray : Some osteochondritis of outer condyle of the femur.

Operation : Internal semilunar exposed and appeared normal. External semilunar exposed, when a large area of osteochondritis appeared over the external condyle, which was partially denuded of cartilage, and with a loose piece one and a half inches across. This was removed and one loose body extruded on syringing.

In plaster of Paris for two months and no weight bearing. The result after one year was good. He was never a games player but considered his knee as sound as the normal knee and did full duty.

*Case 4.*—Fell while running at football ; pain over internal condyle. At operation, after an interval, the internal semilunar cartilage was removed. This did not cure the condition and a second operation later revealed blood-stained fluid in the joint, with erosion and osteochondritis of the internal condyle. Plaster of Paris for two months. The knee after this was still as bad as before and a third operation, exposing the external semilunar, revealed extensive osteochondritis of the external condyle, with irregular, partially loose tags of cartilage and over twelve loose bodies free in the joint.

In plaster of Paris again for two months, but the man was eventually invalided from the Service.

*Case 5.*—While playing hockey he received a blow on the knee with a hockey stick. This caused no severe pain and he continued the game, but synovitis came on later.

A month after, while running, the knee gave way inwards, without locking, but synovitis again occurred, and pain developed whenever he moved the knee. The knee has never been right since and gives way frequently. He has lately felt a loose body in the joint.

At operation an area of osteochondritis was present over the antero-internal aspect of the internal condyle of the femur, and a loose body corresponding in size to this area was loose in the joint cavity. The loose body was removed and the edges of the area of osteochondritis which showed many loose pieces of cartilage were trimmed up.

The damage to the articular cartilage was undoubtedly due to the direct blow from the hockey stick sustained three years previously. This case did not recover, and was invalided.

*Case 6.*—An officer while out fishing jumped down about six feet from

one rock to another. The knee gave way with severe pain, and he was unable to walk.

At operation some weeks later the articular cartilage over the internal condyle showed an extensive antero-posterior split with much disorganization of the articular cartilage. Loose bodies were present. These were removed, and the knee put in plaster of Paris for two months.

I have not been able to obtain a record of the result, but the officer is still serving.

#### CONCLUSIONS.

The conclusions to be drawn from these results are :—

(1) First and most important is that in all cases of fracture of a semilunar, the whole of the cartilage should be excised instead of only the anterior portion. This is only possible by making a posterior incision to expose the posterior aspect of the joint. The only exception may be a bucket-handle fracture or, as I prefer to call it, a fracture dislocation of the semilunar, where one almost always finds the whole of the semilunar lying between the femoral condyles, the fracture having occurred cleanly along the junction of the semilunar with the lateral and coronary ligaments. In such cases it is easy to remove three-quarters of the dislocated portion through an anterior incision, while there is merely a thin strip of semilunar left in situ which it is unnecessary to remove.

It is true that a large percentage of cases recover completely with an incomplete removal. There are, however, six cases of failure totalling 7 per cent, in my figures, which could have been cured by complete removal. During the last two years I have carried out complete removal in some 30 cases of semilunar injury and have been very pleased with the immediate results. Unfortunately, owing to leaving the station and the war, I have been unable to follow these cases up. I am sure, however, that this is the correct procedure.

(2) The greatest care must be exercised not to damage the articular cartilage by blind cutting when removing the semilunar. Tiny fragments of articular cartilage may be shorn off which form loose bodies, and cause a recurrence of knee trouble. To prevent this, the knee-joint should be washed out before closure.

(3) The third conclusion is that osteochondritis should be suspected when blood-stained synovial fluid and loose bodies are present, and if present should be treated by immobilization in plaster of Paris for a time varying with the intensity of the lesion. The failures in my cases were due to insufficient immobilization ; three to six months may be necessary.

(4) Fourthly, that an accurate diagnosis should be made before operation, and that the joint should be explored in successive steps in order not to miss a fracture.

(5) Fifthly, the percentage of failures in the series was 19 per cent, made up as follows : (a) Faulty diagnosis 7 per cent, (b) faulty operative technique 7 per cent, (c) osteochondritis 5 per cent.

## REPRESENTATIVE CASES.

## VERY GOOD RESULT.

Name	Diagnosis	Type of operation	Period since operation	Is knee better than before operation	Is knee as sound as normal knee	Can he play football	Full duty	Remarks
Gnr. W.	Loose internal semilunar cartilage	Excised anterior $\frac{1}{2}$	3 years	Yes	Yes	Yes	Yes	Very good
Pte. C.	Fracture internal and external semilunar cartilages and osteochondritis internal condyle	Excised both cartilages	1 year	Yes	No	Yes	Yes	Very good
Rfm. R.	Fracture internal semilunar cartilage	Excised <i>in toto</i>	9 months	Yes	Not quite	Yes	Yes	Very good
Sig. F.	Fracture dislocation internal semilunar cartilage	Excision anterior $\frac{1}{2}$	7 months	Yes	Yes	Yes	Yes	Very good
Rfm. B.	Fracture internal semilunar cartilage	Excision <i>in toto</i>	7 months	Yes	Not quite	Could, but doesn't play	Yes	Very good
AC2 M.	Fracture dislocation external semilunar cartilage	Excision anterior $\frac{1}{2}$	1 year	Yes	Yes	Yes	Yes	Very good
L/Bdr. S.	Fracture internal semilunar cartilage	Excision <i>in toto</i>	8 months	Yes	Yes	Yes	Yes	Very good. Instructor
L/Cpl. B.	Fracture external semilunar cartilage	Excision <i>in toto</i>	12 months	Yes	Yes	Yes	Yes	Very good
Pte. H.	(a) Fracture internal semilunar cartilage (b) 2nd operation	Excision anterior $\frac{1}{2}$ Excision remaining portion cartilage	1 year 9 months	No Yes	No Yes	No Yes	No Yes	Poor Very good. Showing benefit of removing remaining piece of cartilage
Pte. M.	Old fracture internal semilunar cartilage	Excision remainder of internal cartilage and removal loose body	11 months	Yes	Yes	Yes	Yes	Very good. States his injured knee is stronger than his normal one

## REPRESENTATIVE CASES—continued.

GOOD RESULT.						
Name	Diagnosis	Type of operation	Period since operation	Is knee better than before operation	Is knee as sound as normal knee	Remarks
Bdr. F.	Fracture external semilunar cartilage	Excised anterior $\frac{3}{4}$	4 years	Yes	No	Can he play football? Yes Good
Pte. O.	Fracture internal semilunar cartilage	Excision anterior $\frac{3}{4}$	2 years	Yes	No	Yes Good
Pte. L.	Loose internal semilunar cartilage	Excision <i>in toto</i>	7 months	Yes	No	Not tried, does not think so Yes Good
Pte. F.	Fracture dislocation internal semilunar cartilage	Excision anterior $\frac{3}{4}$	2 years	Yes	No	Yes Good
Rfm. M.	Fracture internal semilunar cartilage	Excised anterior $\frac{3}{4}$	10 months	Yes	No	No. Afraid of injuring knee Yes Good
Rfm. M.	Fracture internal semilunar cartilage	Excision anterior $\frac{3}{4}$	10 months	Yes	No	No. Afraid knee will lock again Yes Good
Sgt. C.	Fracture dislocation internal semilunar cartilage	Excision anterior $\frac{3}{4}$	10 months	Yes	No	Hockey but not football Yes Good
AC1 J.	Fracture internal semilunar cartilage	Excision <i>in toto</i>	5 months	Yes	No	Not yet; was told not to play but knee felt weak Yes Good
Pte. B.	Fracture internal semilunar cartilage	Excision anterior $\frac{3}{4}$	9 months	Yes	No	No; tried to play but knee doesn't feel strong Yes Good
Bdr. C.	Fracture dislocation internal semilunar cartilage	Excision anterior $\frac{3}{4}$	16 months	Yes	No	Good. ? due to posterior portion being left behind Yes Good



## REPRESENTATIVE CASES—continued.

## FAIR OR POOR RESULT.

Name	Diagnosis	Type of operation	Period since operation	Is knee better than before operation	Is knee as sound as normal knee	Can he play football	Full duty	Remarks
Pte. W.	Osteochondritis of internal and external femoral condyles	Loose bodies removed	9 months	No	No	No	No	Invalided
Gnr. R.	Osteochondritis external femoral condyle	Loose body removed	10 months	No	No	No game where great exertion necessary	No	Poor
Pte. B.	Fracture internal semilunar cartilage	Excision anterior $\frac{3}{4}$	1 year	Yes, a little better but still swells	No	No	Yes	Poor. Cure probable if remaining portion of cartilage were excised
Pensioner H.	Old fracture internal semilunar cartilage	Excision of post. $\frac{3}{4}$ of internal cartilage left after previous operation	1 year	No	No	No	Does his work as a miner	Pension element should be taken into account
Sig. W.	(a) Fracture dislocation internal semilunar cartilage (b) 2nd operation osteochondritis	Excision anterior $\frac{3}{4}$	9 months	Yes	No	No	Yes	Fair
AC1 B.	Hypertrophied infrapatellar pad of fat	Pad partially excised	1 year	No	No	No	No	Poor. First operation had poor result because osteochondritis was probably missed
Trp. A.	Loose internal semilunar cartilage	Excision anterior $\frac{3}{4}$	18 months	No	No	No	No	Poor. A fracture of posterior part of cartilage or osteochondritis missed at operation
Pte. B.	Loose internal semilunar cartilage	Excision anterior $\frac{3}{4}$	18 months	No	No	No	No	Poor. ? Fracture of posterior portion cartilage
LAC/B	Loose internal semilunar cartilage	Excision <i>in toto</i>	2 years	No	No	No	Yes	Poor. Cannot account for failure unless fracture of external cartilage missed
AC1 A.	Fracture dislocation external semilunar cartilage	Excision anterior $\frac{3}{4}$	10 months	No worse	No	Yes, but locking occurs at times	Yes	Poor; ? due to posterior portion left behind

It should be possible to improve these figures by better methods of operation and treatment to at least 10 per cent.

SUMMARY.

- (1) The results in 83 cases of operation upon the knee-joint are discussed.
  - (2) A recommendation is made for the total removal of a fractured semi-lunar through anterior and posterior incisions.
  - (3) A description of cases of osteochondritis is given, and the treatment discussed.
  - (4) The reasons for failure in 19 per cent of cases are described, and the procedures recommended to improve these figures are given.
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## PRACTICAL HINTS ON THE TREATMENT OF WAR INJURIES IN FORWARD AREAS.

BY LIEUTENANT-COLONEL R. R. G. ATKINS, M.C.,  
*Royal Army Medical Corps.*

### SHOCK.

SHOCK is the most important factor to be dealt with. Sometimes it develops with extreme rapidity even in lightly wounded. These men are usually very excited, so if a lightly wounded man is in this condition, treat him for shock as a preventive. Hæmorrhage, exposure to cold, wet, hunger and fatigue, pain and anxiety, the nature of the wound, multiple wounds, all these react on each other and can aggravate shock to a very profound degree. Another and most important aggravating cause of shock is the journey from the trenches to the C.C.S. The injurious factors of this journey must be minimized as far as possible by the provision of warmth during all stages of the journey. *All transport must be as smooth as possible.* Smooth running can be helped by reducing the pressure in the tyres over "bumpy" roads. The speed of the ambulance should vary according to the surface, and bends and corners should be approached at a speed that will not cause swaying of the vehicle. Loading and unloading must be carried out as gently as possible, and the patient must never be submitted to sudden jars. The stretcher should always be kept horizontal.

### TREATMENT IN FRONT OF THE R.A.P.

Teach regimental stretcher bearers the urgency of preventing loss of body heat. Carry strapped to the stretcher a waterproof-sheet-blanket package, i.e. a blanket wrapped up in a waterproof sheet. Teach gentleness in handling cases, and the necessity of exposing the body as little as possible when attending to the wounded. Under certain conditions of warfare it may be advisable to keep a few splints at company headquarters. The tactical handling of regimental stretcher bearers should be left to company commanders owing to there being three platoons and only two stretcher squads.

### WARMTH.

During cold weather the mortality from shock rises ; therefore consider every means of increasing warmth. Loss of heat is greatest in the first two hours ; this indicates the value of having dry blankets available for use by regimental stretcher bearers. It is important to put blankets under the patient as well as over. Blankets should be stored in as dry a place as possible, and if possible they should be warmed. In dressing stations

provide a hot-air bath. Figures 1 and 2 show the method of using blankets to the best advantage.

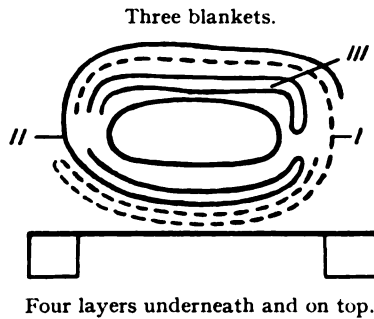


FIG. 1.

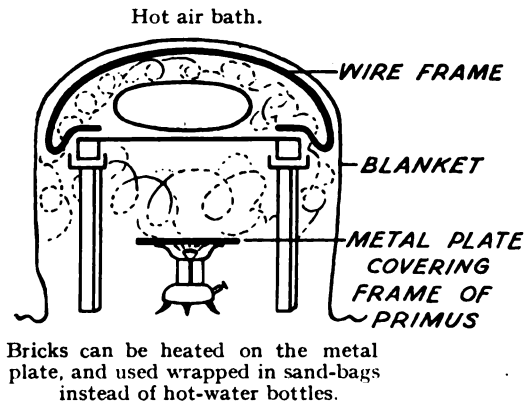


FIG. 2.

Wet clothing should be removed as early as possible. One is often able to remove a wet shirt, dry the back, chest, and abdomen, and wrap the man

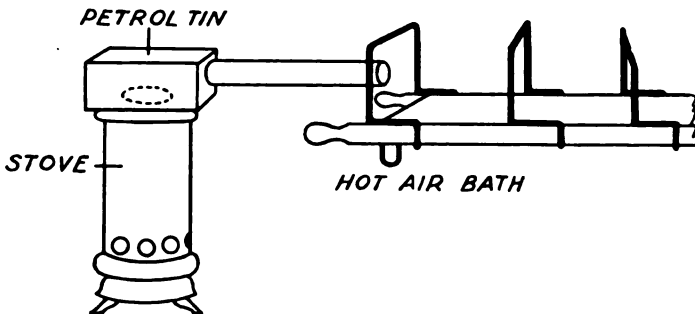


FIG. 3.

in blankets. If wet, boots and socks should be taken off except in severe fractures of the femur, as in these cases the extra shock from the necessary

handling of the patient will more than outweigh the benefit accruing from removing them. Heat can be provided by hot-water bottles or bricks and stones heated, and wrapped, say, in a sandbag. Dressing stations should be warmed. All unnecessary exposure of a man's body should be avoided when doing dressings. If there are many wounded to attend to, treat the general condition of shock in them all before doing dressings on any one man. but hæmorrhage cases must be dealt with at once. Next to cold, men complain of thirst. The provision of fluids is urgent. The best is hot tea with sugar and milk. Fluids by mouth sometimes cause vomiting in cases with severe shock. To prevent this, give in small quantities at a time and *only after* all disturbance incidental to dressing is over, and when the man has "warmed up" a little. If vomiting persists, give rectal or subcutaneous salines. The question of blood transfusion depends often on the military situation and can seldom be done in an advanced dressing station.

#### PAIN.

Pain aggravates shock, therefore its prevention is therapeutic. Unnecessary handling or manipulation for the sake of arriving at a more precise diagnosis is not justified.

#### MORPHINE OR DERIVATIVES.

Do not give under the tongue, as one can never tell how much is either spat out or absorbed. Give half a grain as early as possible. To obtain the maximum benefit and safety from its administration, allow sufficient time for it to act (1) before dressing, (2) before sending the man on the next stage of the journey. This latter is very important, as if the case is evacuated before the drug has acted it seldom acts as a sedative, but it always acts as a depressant on general metabolism. When is morphia to be repeated? Be guided by the general condition and respiration rather than by the size of the pupils. If pain is severe, or the man is restless, repeat. Any cyanosis or pulmonary signs are a contra-indication unless it is imperative to give it.

#### PSYCHOLOGY.

Usually the higher faculties are depressed. If the man is in an excitable condition the faculties are often intensely active, especially hearing, therefore be careful to even whisper nothing that you do not wish the patient to hear. Provide mental rest by maintaining a cheerful atmosphere and tone of voice. At all costs be human. Do your work deliberately and let the man realize that everything possible is being done for him, and that you really are taking trouble over him. This will help to allay his natural anxiety, which is of tremendous importance.

#### TRANSPORT.

Arm cases travel more comfortably as "sitters." Head cases: try and absorb or lessen jolts by a blanket under the head, and use side supports

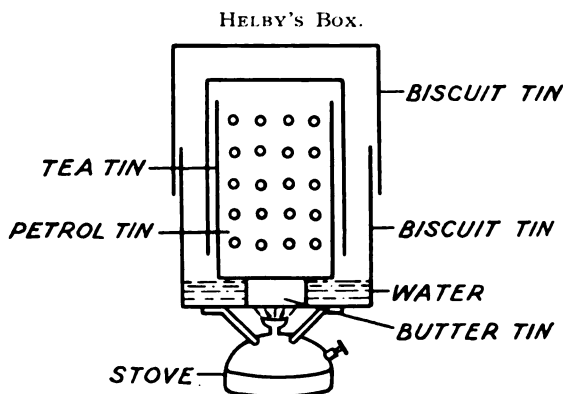
to prevent lateral movement. Chest and abdominal cases : Fowler's position. Put the worst cases on the "ground floor," as there is less danger of swaying, and it is more comfortable, especially when going downhill.

#### REST.

If the situation permits, all bad cases should be left for some time before sending them on, to allow some recovery from shock. If the case is cyanosed and cold with a pulse of 130, rest is imperative. Provide local rest by adequate splinting. Splinting for this purpose is necessary even in large wounds with no fracture.

#### LOCAL TREATMENT.

Remember, gas gangrene is caused by a lack of circulating blood. Contamination is carried into the depths of all wounds. The principle of treatment (in the forward area) is : Diminish fresh infection from surrounding skin, and remove gross contamination and blood-clot from the wound. Unless a foreign body is visible and EASILY removable DO NOT attempt removal. Skin : If dirt and mud are caked on, use soap or lysol and water, and spirit, otherwise tinct. iodine. The value of antiseptics in the wound is doubtful. Use dressings which will not adhere, as this causes damming back of discharge. Use sterile paraffin or sodium oleate



IMPROVED BUT EFFICIENT STERILIZER.

Two sides of the box only are perforated. When sterilized the non-perforated side of tea tin is changed, to cover perforations in petrol tin.

FIG. 4.

5 per cent. If not available use a wet simple dressing. Use all lotions warm. If a wound is oozing use dry dressings. Compound fractures : Remove any COMPLETELY detached and jagged fragments of bone, or foreign body, especially if in the neighbourhood of a blood-vessel. Dressings must not act as a cork to retain discharge. Large gaping wounds : Place loose dressings in the recesses ; if there is a flap place dressings between flaps.

**KEEP THE WOUND OPEN AND DRAINING.** Dressings over a valvular opening are bad ; one can often remove small bridges of tissue in these. Simple bullet wounds require no special attention, but much judgment is required between these simple punctures and severe lacerated wounds. Always use light dressings, not heavy. Heavy dressings may conceal hæmorrhage, especially if the wound is only oozing. Wounded areas are liable to swell, so bandage loosely. If extension is to be applied to a fracture, do it before dressing as the extending may disturb a clot and the resulting hæmorrhage may not be seen, especially if the dressing is a heavy one. Bandage the dressing around the splint.

#### WHEN TO RE-DRESS A CASE.

Never, unless fully justified. Routine dressing at every stage of the journey backwards is bad surgically and wastes dressings.

#### THE FIRST FIELD DRESSING.

If the skin is apparently clean and the bandage is not too tight, leave alone ; otherwise (or if in doubt) re-dress ; if any dressing is soaked in blood re-dress, also if splints are unsuitable or imperfectly applied, bandage too tight or too loose. Only give attention to whatever needs altering.

#### INCREASING PAIN.

Suspect hæmorrhage or the onset of gangrene. Inspect the wound, control any hæmorrhage, and in both cases hurry the evacuation to a C.C.S. In this, or any other type of case which requires immediate attention on arrival at a C.C.S., send a special note stating the urgency.

#### OPERATIONS IN AID POSTS AND DRESSING STATIONS.

These are not advisable. Only operate if ABSOLUTELY justified, such as for hæmorrhage which immediately threatens life, or the removal of a hopelessly smashed limb hanging by threads of tissue. These wounds give rise to severe shock and the pain of a quick slash or scissors cut when under morphia (? local) is less important from the point of view of shock than not removing the limb. There is rarely any hæmorrhage that counts in such cases. Elevate and pack to stop any oozing and keep a tourniquet LOOSELY in position in case hæmorrhage occurs. Retain for an hour to be sure the hæmorrhage is controlled. If a general anæsthetic has to be given, pay attention to the toilet of the stump, so that there will be no need to repeat the anæsthetic at the C.C.S. Such cases travel badly, so retain for twelve hours (if possible).

#### HÆMORRHAGE.

It must be stopped, and this is often very difficult. There is not only the danger of death, but also of very virulent sepsis in the desanguinated. Every ounce of blood is of value. If a large artery or vein is bleeding in

the depths of a wound, operation is often very difficult, so apply a tourniquet and send to C.C.S. as quickly as possible, with a special note. Eighty per cent. of all cases which have a tourniquet on for three hours come to amputation. This may help one to arrive at a decision whether to amputate in a dressing station or send the case to a C.C.S. in the hope of saving a limb but at an increased risk of death from hæmorrhage or shock, inasmuch as a man might not stand the operation at a C.C.S. A nicety of judgment is required in dealing with such cases. The distance to the C.C.S. and time taken on the journey are factors which may be considered here.

It is sometimes possible to "under-run" an artery, or put a forceps on a bleeding point, and the case can be sent on with the forceps in position. If ligaturing a main artery include the veins, as otherwise a large patent vein drains away the meagre blood supply from a weak and enfeebled collateral circulation, and leaves the limb exsanguinated. In certain cases it is not possible to apply a tourniquet, such as on the neck, and operation or even clamping is not possible. Try packing, but if this fails close the skin with as deep through and through sutures as you can, converting it to a diffuse traumatic aneurysm, with the hope that the extra-arterial pressure will become greater than the inter-arterial and so stop the bleeding.

General continued oozing is very dangerous. The dressing soaked with blood is changed, and again at the next stage, and the next; no one realizes that so much bleeding is taking place as it is only oozing, and on inspection does not appear alarming. If possible find and either ligature or clamp the bleeding points. Wounds in the following sites may be suspected of this type of hæmorrhage: The buttocks, calf of leg, around the articulations, and the scapula. If there is ever any doubt about hæmorrhage being controlled put a tourniquet loosely in position before sending the case on. Splint all wounds where bleeding has had to be specially controlled, otherwise the jolting of the journey may restart it. Also make a note on the field medical card if a tourniquet has been put on.

#### SPLINTING.

In all cases splinting must be efficient; splints which do not do what they are meant to do are worse than useless. The opposition of wounded muscles can be overcome by steady mild traction and extension, when obtained they should be fixed firmly. Use the minimum amount of bandaging for ease of inspection at the next stage of journey. Examine all fractures at each stage of journey for the efficiency of the splinting. Use a Thomas splint for femurs and the upper two-thirds of the tibia; below this use a back splint with foot-piece and side-pieces; to prevent the splint falling sideways, tie the foot-piece to both sides of the stretcher.

Joints: Splint all with penetrating wounds. In the knee-joint if there is no fracture use a gutter splint with slight flexion. Always make a note that the joint is open. The integral traction type of splint is the best for all limbs.



**HEAD.**

Gutter type. Remove gross dirt, projecting bone, or foreign body if loose. Use impregnated gauze for packing sinuses. There must be no pressure of a tight bandage over a hole in the skull.

**CHEST.**

Cases of open sucking wounds with severe hæmothorax are badly collapsed, and should be sent on to the C.C.S. as soon as this is justified. These cases have a high percentage of success after operation. Close all sucking wounds by through-and-through suture, or cork with strip of gauze and make airtight with sticking plaster. This treatment plus a short period of rest causes a striking recovery. Always make a note that the pleura has been opened.

**ABDOMINAL.**

Send to C.C.S. as quickly as possible. Wounds of the chest, loins, buttocks, and perinæum are frequently associated with abdominal penetration.

Diagnosis: Rigidity and absence of free movement are of greater importance negatively than positively. Their absence precludes visceral injury, but these signs are also due to other causes, e.g. chest wounds, retro-peritoneal hæmatoma, or injury to the abdominal wall alone. Tenderness is more conclusive than pain, and its presence in the abdomen at some distance from the wound is almost diagnostic. If in doubt treat as abdominal.

Multiple wounds: There is often severe shock. If possible keep for a few hours. Make a note on field medical card of the wounds in the order of their severity.

Lower jaw: Don't press fragments back with a bandage. The tongue often swells and it is obvious that the airway must be kept free. It may be necessary to evacuate face downwards on the stretcher.

Gas gangrene: Develops rapidly in parts deprived of circulating blood. Wounds likely to become affected are those with large destruction of muscle tissue with interference of blood supply. Predisposing factors: Anything which interferes with circulation, i.e. tourniquet, hæmorrhage, constricting splints or bandages, and shock. Often shock cases slide into a condition of profound toxæmia. If main vessel is injured collateral circulation is often so delayed by enfeeblement that a severe infection occurs. If crepitations are felt, this is a late stage. Early signs: Rapid and unexplainable increasing pain and swelling, a sweet offensive odour, wound looks dirty and dark, and exudes foul-smelling dark blood perhaps mixed with gas bubbles. General signs: Thirst, vomiting, rise in pulse-rate, and intense toxæmia. Colour, a lemon yellow, very rarely cheeks a dusky red.

**NOTES ON THE FIRST FIELD MEDICAL CARD.**

*Wound.*—Nature of and severity. Time of wounding. Presence and degree of shock, and severity of hæmorrhage. Dose and time when morphia

given. Dose of A.T.S. Short account of any operation or any special treatment (if foreign body or loose bone removed this MUST be stated, also if pleural cavity or a joint has been opened). Also send on a separate note the names and numbers of any forceps sent down with the case. Don't forget the name of the unit on this note. The bearers taking the case down should bring the forceps back with them. Blankets and special splints, etc., are returned automatically from rearward to forward units.

. . . . .

The anxiety neurosis effort-syndrome cases are war casualties, and in some cases can be prevented. The regimental medical officer has the opportunity of doing this. A good regimental medical officer should be able to talk to any private of the unit in a confidential manner and elicit a similar response from the man, without losing the respect in which he is held by the unit. He should make it his business to go amongst the men and talk to them. It is a good thing to pick out a few really good fellows, ask them to report to him anyone they notice who is losing interest in the unit or in his fellows. Early cases give up their friends and wander off by themselves. They are becoming anti-social. If detected at this stage they can often be prevented from developing further. Win their confidence, talk, and ask questions; it is surprising how men appreciate having someone to unburden themselves to. It may be some trouble at home; it may be that he felt afraid for some time, and some little action was done which on reflection later caused him to consider himself a coward, and he imagined others had noticed it, and so he started to shun his comrades. When these matters are cleared up and put in their proper perspective, you have saved not only a casualty, but the man from the torture of a morbid mind. Those good fellows you have picked out can then easily bring him back again inside the unit, and away from anti-social leanings. Also in the early stages a man's work often deteriorates and this usually leads to reprimands and perhaps disciplinary action, but this has no effect on the man. Officers should be asked to report such cases to the medical officer. Here again worries should be talked over, the company and platoon officer "put wise," and a few words of encouragement and praise from them will often work a miracle, and again you have saved a man.

Any case showing definite nervousness to the extent of unreliability should be evacuated; these are the cases that usually are so full of self-pity that many of their symptoms are due to the reactionary psychological retreat of which you will hear much from them.

A type of case occurs in which a real good fellow "cracks" under no special mental strain but associated with fatigue. A night's good sleep and a day or so resting *with his unit* will very often put him quite right again.

If possible arrange at your regimental aid post accommodation to retain one or two such or other types of cases: obviously this depends on the military situation and cannot always be done.

## MODIFICATION OF THE REGULATION ARMY STEEL HELMET AND BOOTS.

BY K. VERNON BAILEY, M.C., M.D., M.R.C.P., F.R.C.O.G.,  
LATE CAPTAIN, R.A.M.C.

SINCE the War 1914-18 I have pondered this matter with constant interest. As an officer in the line I saw enough during those days to instil into me the beliefs and convictions which I now endeavour to present. In writing of them my mind is constantly carried back to those incidents which engendered these beliefs and from which my facts are derived. Such incidents have remained steadfastly in my memory—as when during the winter of 1917 too many of the highly-trained men of my battery were lost as the result of leg and foot disability and some by head wounds below the rim of the helmet. Apart from the published facts it is obvious that the minor but none the less vital details mentioned later must also have been the experience of very many others and, now that one phase at any rate of the present war is to be enacted under similar conditions, I make this my reason for the presentation of views thus acquired.

In the main I have set out to show :—

(1) That the equipment of our fighting forces—in respect of the head and foot gear—is not only definitely inferior to that of their opponents, but is lacking sufficiently in general adequacy as to represent a direct menace to the efficiency of our armies.

(2) That this lack of adequacy can be rapidly and easily remedied—even in time of war—by simple alterations to the existing equipment. Entirely new equipment is not necessary.

That there is no reason for our troops to be equipped with anything but the best goes without saying, particularly so when anyone laying claim to experience in war will admit that only by allowing to our men every possible facility can they be expected to cope with the highly organized and efficient enemy they have to face.

### A. THE STEEL HELMET.

The regulation steel helmet as worn by our troops to-day is identical with that which first made its appearance some twenty-four years ago, except with regard to an improved interior fitting. In the beginning it was produced as a "shrapnel helmet" for head protection against shrapnel directed downwards from above. During the years that have intervened no improvement has been effected in this form of head-gear, which was notorious to those who wore it on active service as uncomfortable—a headache-producer—difficult to control and interfering with efficiency as well as lacking in adequacy with regard to its qualities of protection.

(1) *Comfort*.—Naturally at the time of its inception and for the years during which it was worn on active service it was accepted as being more protective than the regulation soft service hat, and as time went on a degree of tolerance was developed towards it by most—assisted by practice in the art of wearing it at various angles (or wearing it as little as possible). Ultimately one's head appeared to fit more accurately or vice versa, as one became gradually used to the chronic discomfort it produced. To-day this is perhaps the least of the criticisms which I have to advance with regard to the steel helmet. The improved internal fitting certainly solves this problem to some extent. No longer has the art of balance to be acquired by the soldier in order to keep his helmet in place—that is to say when he is in the upright position. Nevertheless there is no doubt that even with the new type the *balance* due to the shallowness and flat shape is incorrect, with the result that time alone (and not even that in many instances) will accustom the wearer to the belief that he is not being called upon to balance a pile of plates on his head. The modern fitting also does much in taking the weight of the helmet from the vault of the skull. It does much but not everything. In the old type, of course, the whole weight was borne by the top of the head as the original internal fitting soon failed to grip the sides of the head, and many there were who never became accustomed to the consequent headache produced by wearing this helmet for hours on end. The flared shape, however, throws the whole weight on to the fitting itself, which eventually will ease sufficiently to bring about the old state of affairs. A fitting which is loose to begin with will accelerate this.

These details definitely mitigate against the comfort of the helmet even when worn under the best conditions and, as I shall again mention later, there is no doubt that the actual *comfort* of the head-wear of the troops is of vital importance to their efficiency. This detail directly influences not only their tempers but their endurance on parade and on the march, and particularly their fighting ability. No soldier can give of his best if he has even to *think* about his head-gear.

(2) *Adequacy of Protection*.—In this respect the regulation helmet leaves much to be desired. As I have said, it was devised primarily for protection against shrapnel sprayed from above. There is no doubt that it should be so designed as to give at least some protection from splinters or bullets reaching the head from a lateral direction or from below upwards. Much more frequent than shrapnel from above in modern warfare are nearby bursting shells at ground level. These send splinters and debris upwards. Machine-gun and rifle bullets proceed more or less laterally to the target. Protection from glancing blows in both these respects is lacking. The shallow flared shape gives little or no protection to the sides of the head and base of the skull. The umbrella effect of this shape is quite unnecessary to the further protection of the top of the head. In fact it is just the shape which produces unwieldiness. The flanged edges are considerably more of a danger than a protection as besides contributing to a lack of balance they

make for dislodgement of the helmet when struck. The rim as at present constructed even has a tendency to deflect splinters which strike it downwards to the face and neck. On many occasions I have seen men killed or wounded by bullets or shell fragments piercing the skull in the exposed temporal and occipital regions by entering below the flanged edges. Expecially are these regions exposed in many cases by the habit commonly acquired of wearing the helmet at an angle to one side of the head. Therein lies one of its chief disadvantages in so far as the tendency must naturally exist for *comfort's* sake when wearing a shallow flat type of hat. The analogy is universally seen in civilian head-wear of the flat type. I consider it essential that the helmet should give adequate protection to the vault, sides and base of the skull equally. Without this the soldier enters the combat at a 50 per cent disadvantage to the enemy.

(3) *Interference with Efficiency.*—From what has been said above the interference with fighting efficiency in consequence of wearing an uncomfortable and ill-protecting helmet is obvious. From the practical point of view the lack of close fit of the helmet with its liability to dislodgment (even with the new internal fitting) is a definite handicap to the mobility of the soldier. Advancing to the attack, in the dark over rough ground, falling into shell-holes, jumping into and out of trenches, running, dropping flat and getting up dozens of times, colliding, being jarred and knocked over—all in full battle kit with both hands occupied—calls for a head-gear which will stick under all conditions and in all circumstances close to the head of its wearer.

The flanged edges of the helmet strike the edges of a trench or other obstacle in advance of the head and the helmet is knocked off if the chin-strap is carried at the back of the head or uncomfortably dislodged if the strap is under the chin. In which case it has either to be found again (in the dark), done without, or readjusted. In any case the soldier's mind is taken off his job. In this connexion I remember many occasions where men preferred their soft hat for use in night raids or attacks for these reasons. From this point of view also it is essential that the side of the helmet should fit closely to the head. It is essential that a man should feel full and complete *control* over his helmet. It should be as much a part of his head as a glove is of the hand. Only by this knowledge will the man feel that degree of safe comfort and confidence which is essential to his freedom of movement and consequent efficiency.

One cannot overstress the *psychological effect* in action which can be exerted by the soldier's helmet. If it has the right "feel" and he knows that it will stay with him whatever he does in the way of acrobatics during those moments in which all his concentration and nerve are required elsewhere he will not have to think about it and he will be able to produce his best. Alternatively his *morale* will be adversely affected as the result of an uncomfortable uncovered or bruised head at the time when it is necessary for this morale to be at its highest.

(4) *Appearance*.—Whilst perhaps not entirely axiomatic—"What looks right is right"—can usually be taken as representing sound judgment in the assessment of mechanical efficiency. In this respect one has only to encounter any familiar figure in civilian dress wearing a regulation steel helmet to notice immediately the detraction from that particular person's standard of appearance. Nor does this detraction owe itself merely to the strangeness of the head-gear, but rather to the fact that a suggestion of bizarre discomfort is conveyed which produces a faint incongruity of effect derogatory in turn to the personality, smartness, and military appearance of the wearer. This effect is strikingly observed in those instances in which the helmet is worn with civilian clothes. Now a Service helmet should not detract from the military personality of the wearer. On the contrary, it should add to it if possible. The German helmet certainly does this. I feel quite sure that much of the terror of the Gestapo would be removed if its members could be persuaded to wear our steel helmet. When worn in conjunction with Service uniform the effect is not so bad, but it is far from good. The flat shape prevents the helmet from being always worn straight on the top of the head. The British face and features are not sufficiently oriental to deal with the San Pan. The result is that a soldier soon "trains" his helmet to accommodate itself to a particular angle which suits himself. This angle is by no means uniform. On parade a line of men will sometimes exhibit a variety of angles of helmet. The result does not make for smartness or soldierly appearance. It makes for sloppiness and irregularity and, notwithstanding the fact that the helmet is essentially an active service head-gear, these effects should not be condoned. It is essential from the point of view of appearance that the helmet should be worn centrally over the head. The British helmet does not lend itself to wear in this way. This is bad from a disciplinary point of view and in this respect will hamper the training of recruits to the new armies. Moreover, the British helmet gives the impression of a temporary unfinished product which does not do justice to the appearance of our men. Again from a military point of view, the qualities of strength and fierceness calculated to instil fear into the enemy are detracted from by its use. There is no doubt that this is a big factor in the attack, and anything which helps in this way in relation to equipment should receive very careful attention. The enemy sees the heads of the approaching attackers—psychologically he is influenced thereby. It is essential that he should be influenced in our favour—or at any rate not the reverse.

A friend recently described a lacrosse match in which he was playing against a team who were largely equipped with a well-known type of American head protection. His comment was to the effect that these players appeared to "put the wind up" the opposition successfully.

In the same way there is no doubt that most continental helmets succeed in conveying this effect to some extent, and certainly a line of advancing German troops *looks* more formidable than it would do if dressed in the British helmet.

In the time to come it appears that this country will have to train large numbers of men to bear arms. These men, unused as they are to any previous military training or discipline, have to be made to *look* like soldiers. Their head-wear is an essential factor to this end. The present helmet does not help them to either look or feel like soldiers. It is not necessary or suggested that the German helmet should be copied. Individuality and distinctiveness must be preserved, particularly for ease of identification, but by comparison with any continental type it is poor. Developed during an emergency a quarter of a century ago, no notable improvement has been effected since. Its use is a handicap to the troops who wear it. There is no necessity for this handicap and our Army should not have to bear the burden of it.

#### ALTERATION TO THE HELMET.

With the above consideration in view I have had straightforward alterations carried out to the regulation helmet which I believe give the results aimed at.

The main reason for this presentation of my views is the fact that these results can be obtained by alteration alone and that completely new models are not necessary. From the practical point of view, therefore, it would be possible without undue difficulty to alter the existing stocks of these equipments before issue and to recall already issued stocks in batches for alteration and re-issue. After the requisite die is made for the helmet and the leather extensions manufactured for the boots, the change could be quickly effected without upsetting the rhythm of manufacture.

I would not suggest that the British should directly copy any one of the continental types. Indeed, as far as the helmet is concerned there is so little difference between these types wherein to effect another possessing a distinctiveness of its own that almost any modification is apt to encroach to some extent upon one or the other. Nevertheless, I consider that the helmet as modified possesses individual features of sufficient number and importance to render it distinct. If the effect is inclined rather more to the continental type I would nevertheless assert that it is in no way an admission of direct copy if a modification is effected which is obviously aimed at fuller protection and adequacy, even if these factors have already received greater consideration by the more military continental nations.

I have had the following alteration carried out to a Service helmet :—

The posterior half of the circumference of the brim is bent downwards so as to form practically a continuous line with the lower part of the dome of the helmet. This is not quite possible on account of the diminution of the circumference of the actual outer rim. The effect is a slight flair only of the brim when bent down. The brim at the sides is bent vertically downwards so as to present a flat aspect at the sides of the head. This flattened area runs smoothly into the posterior rounded portion. The



Regulation and Modified Helmets, side view. Protection of the temporal regions of the head.  
The improved appearance is apparent.



Regulation and Modified Helmets, front view. The closer lateral fit, protection and neatness  
of the modified form is apparent. The improvement in the "balance" is shown.



brim at the front of the helmet is unaltered and merges at its lateral angles with the anterior parts of the flattened side-pieces.

The resulting helmet, with its increased depth affecting the posterior two-thirds of the circumference, is still sufficiently distinctive. It remains much shallower than the German type—of which it has not the high dome, the wide flanged brim, or the cut-away and shaped sides. It is also distinct from the French, Polish, Dutch, or Belgian types.

The protective effect is to give approximately a further inch of "covering" to the base of the skull and neck and one and a half inches to the temporal regions of the skull and upper aspects of the face. Apart from this the modified shape mitigates against deflection downwards on to the face, neck, and shoulders of splinters striking the helmet obliquely—a danger which I consider is definitely present in the regulation type. The modified shape also gives much-improved protection to the face and neck from rain and wind—a factor of importance as anyone with experience of marching in heavy rain will agree. In general the improvement in the effect of military smartness, competence, and protection is demonstrated by the comparative photographs. The improvement in the psychological and moral effect to the wearer must vary directly as these factors.

#### B. THE BOOTS.

Much has been written during the last few years about the mechanization of our Army. Much also about the fact that the men will be carried from one battle zone to another by means of mechanized transport and that no longer will they need to "foot-slog" as in the days of old. I am quite sure, however, that the Army commanders know full well that the ability of the infantry to effect forced marches may be put to the test in this war equally as much as in the last. In this connexion one learns of marches of over 30 miles per day by the highly mechanized German forces in the Polish campaign. The famed marching ability of the German infantry is due not only to the physique of the men and their training, but to the relative efficiency of their foot-wear, which combines comfort with protection and freedom of action to the leg.

(1) *Constriction of the Leg*.—Most British infantry officers with experience in the last war will remember the "casualties" on the march produced as the result of the boot-and-puttee combination. The top of the boot frequently caused a chronic "fridge" at the front of the foot—unless it were left so loosely tied as to not only look extremely untidy, but to be incapable of control by the lower end of the puttee. More than this, the constriction of the calf brought about by the puttee inevitably caused muscular cramp which ultimately forced men out of the ranks.

Where marching ability or freedom of action is necessary, it is essential to so clothe the leg as to leave free play for the constant contraction and relaxation of the muscles of the calf and shin. Any leg-wear which constricts not only negatives efficiency in this way, but in the long run produces a

chronic dilatation of the veins of the foot and lower part of the leg which renders the soldier a permanent casualty. How many cases of varicosity of this type were produced during the last war is a fact which was then well appreciated, but one from which we have failed to derive a lesson.

Some modification in the puttee has certainly been made. The short gaiter has made its appearance in conjunction with the "battle dress." This apparently is not uniform, and the half-puttee as well as full puttee are still much in evidence with the regulation trouser. In fact, from the photographic evidence one occasionally sees troops on the march dressed with a lack of uniformity in this way.

Each gaiter is fastened by two straps with metal buckles. These buckles are exposed, so that ultimately they will be rendered unserviceable and even dangerous by rust and corrosion. As regulation equipment the gaiters are not without obvious disadvantages. The mechanics of buckles is such as to be incapable of withstanding the constant rough usage to which they must be subjected. The breaking of one buckle only means that one gaiter cannot be satisfactorily used and that the pair may thus be lost to the soldier until replacement can be effected.

(2) *Protection against Damp and Cold.*—The main danger, however, in the boot-cum-puttee or "battle" dress as foot and leg wear, is the effect of chronic damp. One fact irrefutably stands out, and that is that in spite of all mechanization and the presence of permanent fortifications, the fighting troops are sure to encounter *mud*. Indeed, at the time of writing it has already arrived following the first rains, and now that our men have to live in it the full handicap of the boot and puttee as well as the "battle" dress with gaiter will be understood. The massive casualties produced by the effect of the mud alone in the last war are still to be remembered. The full puttee kept a certain amount of damp out for a short time. After becoming soaked it contracted on the leg, and unless it could be regularly removed and dried—which was not the case—varicose veins, rheumatism, and "trench feet" were the inevitable results. To those with experience of the Ypres Salient, the losses from these causes were as devastating and dangerous to the morale as those produced directly by the enemy. The "battle" dress with gaiter or short puttee will afford even less protection. The lower end of the trouser will remain soaked and will become caked with mud which will infiltrate through the top of the boot to the foot inside. The efficiency, the health, and the morale of the troops thus affected are destroyed.

To combat this extreme danger it is essential that the foot and leg be uniformly protected as far as possible from damp and cold and that there should be no constriction of the leg itself. A leg wrapped tightly to the knee by a cloth puttee has no protection from continuous damp and cold. In fact this is the way to ensure that the more distal part of the limb, viz. the foot, will become as embarrassed as possible by cooling the arterial circulation to it. This fact, in conjunction with the effect of wet, produces that form of localized gangrene associated with "trench feet."

The protection under these conditions given by the gaiter is inadequate, as it is not sufficiently a part of the boot at the instep and does not cover the leg to a sufficient height. Nor does the gumboot answer the question of adequate protection against damp and cold. The rubber gumboot causes the foot to "sweat" owing to imperfect ventilation, and this fact, coupled with the ineffectiveness of relatively thin rubber in keeping out the cold, results in a footwear which may be useful for short spells of duty in trench warfare, but which is obviously unhealthy and uncomfortable for continuous use. The gumboot therefore must be restricted for use in front-line positions. It is of course useless for marching purposes. As I have said, not only do these forms strongly mitigate against efficiency in marching, but also against protection in resting or working under wet conditions. Moreover, the consequences produced are largely permanent. The men involved become permanent casualties from the active view-point and large numbers are crippled for life.

One can go further and say that the puttee was first universally produced for use by the British Army as a protection against snake-bite and sand-flies in the Boer War. Even then it was recognized as bad wear for marching purposes. Since then it has extraordinarily enough persisted through a European War of four years' duration notwithstanding the disasters consequent upon its use.

The puttee—in full or half—or gaiter may be comfortable and fairly smart for wear on parade, and may be adequate enough for training at home under ordinary conditions where marching is controlled and warm barracks with a change of clothes greets the end of the day, but as equipment for constant use under all conditions of continental warfare it is a definite handicap and menace to the efficiency and lives of the men who have to wear it.

#### ALTERATION TO THE BOOTS.

I consider that these should be modified : (1) To relieve all constriction of the limb itself—to allow free action to the muscles and freedom of circulation ; and (2) to give as good a protection as possible under wet conditions, especially that type of wet associated with constant contact with mud. Here again we must maintain individuality, and I consider that in its details and appearance this modification differs essentially and sufficiently from any other type.

I have had the following alterations with additions carried out to the regulation Army boot :—

An extension of the same type and strength of leather as that of which the boot itself is made, is sewn to its upper margin. This extension covers the leg to the level of the upper bend of the calf. The inner aspect is carried round as a flap to the outer side of the leg and is fixed neatly over and to its counterpart by a single leather "strap" fixture which fits firmly through a strong surface slot made from the same material as the latter. The upper

and lower edges of the outer flap are cut on the straight and the line of the flap is vertical. The effect, therefore, is not that of a legging but of a flap.



Modified Army boot, "heavy" pattern. Leather extension 9" in length. Single reinforced strap and slot fastening. Reinforced inner flap. Extended tongue. Smart, protective and weatherproof. One-piece and easily adjusted and removed.

over extension to the boot of strict military appearance. The tongue of the boot is elongated and affixed to the level of the instep to maintain waterproof quality.

The result of this alteration is to provide a weatherproof covering to the foot and leg up to the top of the calf. The construction of the leather flaps at the instep, together with the affixed tongue, renders the boot waterproof at this vital point. The height of the extension, whilst providing complete protection, is not so high as to prevent free access of air to the limb and at the same time maintains an optimum weight and balance of freedom in marching and manœuvre. The additional weight of the extension is negligible. The foot is easily put into or pulled out of the boot when the laces are loosened. The ends of the laces are readily concealed beneath the extension and the over-riding flap is rapidly secured by the single "strap" fixture which, owing to the relative pliability of the leather used, has no tendency to loosen itself. This fixture may be pulled tight for neatness on parade. On the other hand, for comfort on the march and so as to allow ease of action to the leg muscles, the "strap" can be partly pulled through the "slot," thus loosening the whole extension without in any way mitigating against the appearance.

The fact that the lower part of the boot is laced in the ordinary way makes for firmness in heavy going—a point which is troublesome in the jackboot or gumboot, and the fact that the whole structure is of stout leather makes for warmth in cold conditions (long socks can be worn) and adequate ventilation under hot conditions—points which again are not covered by those types.

An alternative model has also been prepared which differs in two respects only: (1) The extension is  $\frac{3}{4}$  inch less in length, and (2) "twin" strap fastenings are used—one  $1\frac{3}{4}$  inches from the lower end and the other 1 inch from the upper end of the extension. Perhaps this may be considered firmer and lighter, but in principle it differs in no way from the former type.

In contrast to the use of puttees or gaiters the protection against wet which this boot gives to the lower end of the trousers is of great importance, particularly where men have only one pair of trousers issued or available. In this respect, therefore, the boot effects an economy.

The modified boot is quickly and easily put on and taken off. It is in one piece—therefore speedily found under emergency conditions or in the dark. This cannot be said of the boot-cum-puttee or gaiter combination, parts of which are easily mislaid in billets or dug-out, particularly when emergency intervenes. The modified boot, apart from being more rapidly adjusted, is also more easily and rapidly removed. This is of great importance following a wound, especially in that part of the leg clothed by the boot. The soldier himself can, without effort, remove the whole covering to the leg. The danger which is present with the puttee—namely the carrying into the wound of the dirty or muddy cloth which is tightly wrapped round it with the consequent contamination—is also negatived.

The modified Army boot is thus comfortable, weatherproof, and can be made waterproof by the use of dubbin or other oil to the extension. It also provides much greater protection against obstacles such as barbed wire than does the standard equipment. Its essential features make it an improvement on the German form. It represents efficiency in military leg-wear.

## CONCLUSION.

My object in presenting this dissertation is based upon my belief that nothing short of every possible facility should be afforded to those many thousands of men who in the months or years to come will be transferred from one form of living to a diametrically opposed form under which they will be expected at all times to produce their utmost efficiency.

My views are, of course, deduced from experience of the last war. During that time the infantry spent the years in conditions and situations as dictated by the current state of the campaign. If the present war on land develops, such a state is again likely to become established. Even pending this stage, however, the troops have to maintain a constant existence under conditions which may approximate in great degree to the more exacting ones of active warfare.

If these modifications in the essential and vital equipment of our fighting troops were accepted by the War Office, it would not be a matter of too-great difficulty, even under the present war conditions, to alter existing stocks and to recall equipment in stages for alteration and re-issue. Moreover, the cost of these alterations and additions is relatively little.

From my own experience I can well imagine the relief with which the re-issue would be received by the men directly concerned, as well as the approval of the officers who command them.

Without bias, I am convinced that not only would these modifications, if adopted, be directly and indirectly the means of saving many lives and much suffering, but also, as the result of that feeling of being efficiently equipped, would tend to bring a heightened morale to our troops generally.

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## MEMORANDUM CONCERNING THE USE OF SULPHONAMIDE DERIVATIVES.

*This memorandum supersedes all previous memoranda on this subject. It has been extended to include the treatment of the commoner infections known to respond to this group of drugs.*

*We have deleted certain paragraphs from the Memorandum as issued by the War Office (EDITOR).*

**PREAMBLE :** Experimental and clinical results having proved the effectiveness of sulphonamide derivatives in the treatment of infections with hæmolytic streptococci, meningococci, gonococci, pneumococci, and *B. coli*, and, having indicated that these compounds have also an action on some, at least, of the anaerobic gas-forming bacilli, it is of importance for the medical officer to have knowledge of :—

(1) The designation of the various compounds in use and the choice of compound.

(2) The principles governing the administration of these drugs both for prophylaxis and treatment.

(3) The toxic reactions to which the drugs give rise and how these may be avoided or treated.

This memorandum sets out the above general facts and makes particular recommendations for :—

(A) The prophylaxis and treatment of wound infections due to streptococci and gas gangrene bacilli.

(B) The treatment of meningococcal infections.

(C) The treatment of pneumococcal infections.

### DESIGNATION OF SULPHONAMIDE COMPOUNDS AND CHOICE OF COMPOUND.

**Sulphanilamide :** Synonyms : Sulphonamide P, Prontosil album, Streptocide, Colsulanyde. In France : Septoplax, Neococcyll. Supplied in tablets of 0.5 g.

**Sulphapyridine :** Synonyms : M & B 693, Dagenan. Supplied in tablets of 0.5 g.

**Sulphapyridine soluble :** Synonyms : M & B 693 soluble, Dagenan sodium. Supplied as 33 per cent. solution. 1 g. in 3 c.c.

**Sulphathiazole :** Provisional name. Market supplies not yet available.

It is recommended that sulphapyridine should be exhibited in the following conditions : Gonorrhœa, cerebrospinal meningitis, pneumonia and pneumococcal infections, staphylococcal septicæmia, gas gangrene.

Sulphanilamide should be the drug of choice in the prophylaxis of wound infections and the treatment of erysipelas and cellulitis, meningococcal

carriers, wounds known to be infected with hæmolytic streptococci (*acute phase*), follicular tonsillitis and otitis media, *B. coli* urinary infections.

*Note.*—Sulphanilamide is inactive against all pneumococci with the exception of Type III and has but little action on staphylococci.

#### PRINCIPLES GOVERNING ADMINISTRATION OF SULPHONAMIDE DRUGS FOR PROPHYLAXIS AND TREATMENT.

The principle of effective treatment is to obtain a high blood concentration of the drug as rapidly as possible and to maintain this concentration at an effective level over a period of time. Because the drugs are rapidly excreted it is necessary, in order to maintain an effective level, to administer four-hourly *night and day*. The oral route of administration is best for maintaining a steady blood concentration and no other route should ordinarily be employed for treatment. There are occasions on which a soluble preparation for injection is of great value, such as when swallowing is impossible, when gastric upset prevents absorption, and in neglected cases in which it is imperative to lose no time in obtaining an effective blood concentration. A continuous course of a soluble preparation should only be used when oral therapy is impracticable. Courses of treatment for established or developing infections should very seldom exceed ten days. A further course should not be prescribed except in special circumstances and with adequate precautions against agranulocytosis. As a general rule when an infection is susceptible to the action of these drugs the result is rapid when they are administered in full doses.

When an infection appears to be controlled, as judged by the temperature, small doses should be continued for a further two to four days in order to prevent relapses.

#### TOXIC REACTIONS.

Certain individuals are unduly sensitive to the drugs and toxic reactions are liable to be caused by prolonged courses, repeated courses, and grossly excessive doses. When toxic symptoms are severe the drugs may be quickly washed out of the body by inducing simple diuresis with water.

The following is a list of the toxic reactions; the reactions may be classified as (i) mild, (ii) serious :—

##### (i) *Mild.*

*Nature of Reaction.*—Vomiting : Especially common with sulphapyridine. Cyanosis : Cyanosis may be temporarily dispersed by giving 0.5 to 1.0 g. per day of methylene blue by the mouth. Cyanosis *per se* should not prohibit continuance of treatment. Acidosis. Drug fever : There is no certain means, apart from physical signs, of distinguishing this from fever due to recrudescence of infection. With true drug fever omission of the drug brings about an abrupt fall in temperature. Dermatitis : Omit drug and induce diuresis with water or simple diuretic. Check leucocyte count if



## 174 *Memorandum Concerning the Use of Sulphonamide Derivatives*

possible. Dizziness, headache: If intolerable, administer fluids freely. Check leucocyte count if severe. Leucopenia: Negligible unless rapidly progressive to below 3,000 leucocytes per c.mm. Hæmaturia (sulphapyridine only): Administer fluids freely. Jaundice and neuritis: Omit drug. Induce diuresis. (*See also* Hæmolytic anæmia.)

### (ii) *Serious.*

Agranulocytosis: Occurs after eight days or more of treatment. Incidence rare. Leucocyte count (seventh day onward) only method of diagnosis. Other symptoms: headache, deterioration of condition, fever, sore or ulcerated throat. Treat: Abundant fluids, pentnucleotide 0.35 g. intramuscularly twice daily, transfusion of *fresh defibrinated blood* and preferably from donor who has had pentnucleotide four to five hours before. Hæmolytic anæmia: Occurs early (two to four days). Incidence rare. Mortality low. Early signs jaundice and hæmoglobinuria. Omit drug, induce diuresis, transfuse if necessary.

## PROPHYLAXIS AND TREATMENT OF WOUND INFECTIONS DUE TO STREPTOCOCCI AND GAS GANGRENE BACILLI.

For the time being it is recommended that a prophylactic course of sulphanilamide should be given to all wounded in whom there is reason to fear septic infection or gas gangrene. This should be started as early as possible (gas gangrene sometimes develops within the first six hours), and should be continued for at least four days in order to protect the patient against the risk of streptococcal infection contracted later in hospital.

### ADMINISTRATION.

For prophylactic purposes it is recommended that the drug used should be sulphanilamide. Prophylactic treatment may be by oral administration or by local application to the wound. For the treatment of established infections either sulphanilamide or sulphapyridine may be used.

*Prophylaxis.*—(a) *Oral*: The first dose should be 1.5 g. (3 tablets) of sulphanilamide dissolved in hot citric acid or lemon in order to get rapid absorption. Subsequent doses, starting two hours later and continuing at four-hourly intervals for four days, should be 0.5 g. (1 tablet) as an uncrushed tablet in order to obtain delay in absorption. Dosage: First day, 4.5 g.; subsequent days, 3 g.; total, 13.5 g.

*Note.*—If the beginning of treatment has been unduly delayed or if the clinical condition gives reason to fear that gas gangrene is already beginning, the first two of the above doses should be doubled.

(b) *Local application*: The incorporation of 5 to 15 g. of powdered sulphanilamide into the depths of the wound at the time of débridement has been suggested as an alternative method of prophylactic treatment which may prove valuable, since the drug is readily absorbed from the wound into the blood stream and will also tend to check the development of bacteria

in and around the wound itself. The effects of such treatment must be observed, clinically and bacteriologically, on a selected group of cases before any decision is reached as to its wide application in war wounds.

*Treatment: Sulphanilamide or Sulphapyridine.*—(a) *For gas gangrene and very severe streptococcal infections:* The first dose should be 2 g. (4 tablets) dissolved in hot citric acid solution or lemon. Subsequent doses, starting two hours later and continuing at four-hourly intervals for two days, should be 1 g. (2 tablets) uncrushed. After the first two days the dosage should be gradually reduced as the clinical condition improves, but the interval between doses should not be more than six hours for several days. Small doses, e.g. 3 g. per diem, should be continued for three or four days after the temperature has come to normal and the clinical condition has become satisfactory. The duration of treatment and the total dosage will vary somewhat, but the latter should seldom exceed 35 g.

(b) *For streptococcal infections of moderate severity:* Dosage as for (a), but the total dose in the first forty-eight hours need not exceed 6 g. each day; sometimes 4 g. will be enough.

*Note.*—Hæmolytic streptococci (and possibly also gas gangrene bacilli) will sometimes persist in a wound long after the clinical condition has become satisfactory. Chemotherapeutic drugs should not be continued for this reason. It will seldom be advisable to prolong the treatment of wound infections beyond nine or ten days.

#### THE TREATMENT OF MENINGOCOCCAL INFECTIONS.

Groups I and II meningococci are equally susceptible to the sulphonamide derivatives. The combination of antiserum and chemotherapeutic agents does not appear to influence the course of the disease. If serum is used it should be given intravenously or intramuscularly and not into the theca.

(a) *Routine Treatment.*—Either sulphanilamide or sulphapyridine may be used, but the latter is slightly more effective and has the advantage of being active against pneumococci as well as streptococci and meningococci.

The total dosage during twenty-four hours should be 8 g. and in extreme cases up to a maximum of 10 g. The spacing of the dosage is important. The compound should be given four-hourly night and day. At the beginning of treatment half the total twenty-four hour dose should be given during the first two administrations. After these initial administrations, the twenty-four hour dose should be divided so that an equal amount of the drug is administered every four hours. This procedure should be continued for two and a half to three days, and then the dose gradually reduced over the next six days to 2 or 3 g. per diem. It is important that the administration should not be interrupted. To prevent recurrence of infection administration should continue for some days after the disappearance of clinical symptoms, but normally the total period need not exceed nine days.

(b) *Special Treatment.*—*Fulminating cases:* The onset may be extremely rapid, and it is essential, therefore, that the optimum blood concentration

of the drug should be attained at the earliest possible moment. The first dose should consist of two injections given simultaneously : an intravenous injection of 1 g. sulphapyridine soluble, diluted in three or more volumes of saline, and an intramuscular injection of 1-g. sulphapyridine soluble. The second dose should be an intramuscular injection of 1 g. sulphapyridine soluble four hours later. Subsequent doses must be judged by the condition of the patient. Dosage may be continued according to the scheme given above for cases of delayed diagnosis and treatment. Three or four pints of fluid daily should be given by whatever route is practicable, either oral, rectal, subcutaneous, or intravenous.

(c) *Treatment of Carriers.*—The following scheme has proved to be successful : 1 g. sulphanilamide is given by the mouth every eight hours and continued for six days, but not beyond this period. Local application of the drug has proved to be valueless.

#### THE TREATMENT OF PNEUMOCOCCAL INFECTIONS.

Sulphapyridine must be used for the treatment of all pneumococcal infections. Sulphanilamide is inactive against all pneumococci with the exception of Type III.

*Lobar Pneumonia.*—For the treatment of lobar pneumonia the following dosage of sulphapyridine is suitable for the average case. 5 g. should be administered in the first twelve hours in lots of 2 g., 2 g., 1 g., four-hourly. This is followed by 1 g. four-hourly, six-hourly, or eight-hourly according to the response. The total dosage administered would be from 26 to 35 g. It is important that treatment should not cease immediately a crisis occurs, but should continue for at least forty-eight hours after the temperature becomes normal.

Should an empyema arise, it cannot be controlled or dispersed with sulphapyridine, though the drug may be used as an adjuvant to surgery.

#### THE TREATMENT OF GONOCOCCAL INFECTION.

Chemotherapy should be employed in all cases in which there is no contra-indication, such as previous intolerance, certain dermatoses and blood diseases, renal disease, jaundice and neuritis. Optimal dosage has not yet been settled, and the following recommendations may require modification with further experience.

(a) *For Cases of Less than Ten Days' Duration.*—Sulphapyridine is at present the most efficient preparation. The following scheme of dosage is suggested :—

The tablets should be powdered and given in milk or water. 1st day of treatment : 2 g. at once and thereafter 0.5 g. every four hours during the day, and 2 g. at bedtime. 2nd day of treatment : 1 g. on rising, 0.5 g. after breakfast, dinner, tea and supper, and 1 g. at bedtime (total 4 g.). 3rd to

7th day of treatment : 1 g. after breakfast, 0·5 g. after dinner and tea, and 1 g. at bedtime (total 3 g.).

If signs of urethritis persist longer than three days, treatment is continued at the rate of 3 g. a day for a further three days. Sulphapyridine should not be administered continuously for more than ten days at a time.

During the above treatment a milk diet is advisable for the first three days, and thereafter a light diet with avoidance of sulphur-containing food-stuffs.

(b) *For Cases of More than Ten Days' Duration when First Seen.*—Sulphanilamide appears to be as effective as sulphapyridine and is much cheaper. The dosage may be on lines similar to those suggested above, but 25–50 per cent higher.

#### THE TREATMENT OF SUNDRY OTHER INFECTIONS.

*Staphylococcal Septicæmia.*—Sulphapyridine is the most effective drug. The course required is similar to that described for lobar pneumonia.

It would appear from experimental evidence that the recently introduced compound sulphathiazole is superior to sulphapyridine in the treatment of staphylococcal infections.

*Staphylococcal Pneumonia.*—Staphylococcal pneumonia arises usually as a sequel to influenza. The mortality is high. Sulphapyridine appears to influence the infection in a proportion of cases and should be prescribed in the higher dosage recommended for pneumococcal pneumonia.

*B. coli Urinary Infection.*—Sulphanilamide should be used. An average course is 1 g. four-hourly for four to five days.



## Editorial.

### FOOD.

EXTENSIVE research has led to the isolation of one vitamin after another and the determination of their chemical nature. Pure vitamins have been synthesized and are now used for medical or other purposes. On the chemical side the latest information is the determination of the formulae of *tocopherol* or vitamin E, and of *adermin* or vitamin B<sub>6</sub> and vitamin K. About two years ago pure vitamin A was given the name *axerophthol* because it is a specific for healing xerophthalmia. *Axerophthol* is derived from carotene in plants. Vitamin B<sub>1</sub> is called *aneurin* and the synthetic compound is used in medicine. Vitamin B<sub>2</sub> is called *lactoflavin*, or *riboflavin*. Synthetic ascorbic acid, or pure vitamin C, is available as a commercial preparation. There are several forms of vitamin D. The vitamin D in fish liver oils is not the same as vitamin D<sub>2</sub>, or *calciferol* prepared from *ergosterol* by the action of ultra-violet light. From cholesterol by a special oxidation process there was derived a substance 7-dehydrocholesterol, which on irradiation becomes vitamin D<sub>3</sub>. There appears to be some oxidizing mechanism in the bodies of fish which without the agency of light changes minute quantities of cholesterol into the active vitamin 7-dehydrocholesterol which is probably identical with the original vitamin D in cod-liver oil.

During the last two or three years nicotinic acid (vitamin B<sub>3</sub>) has proved to be curative of pellagra, a discovery of much value in those maize-eating countries in which pellagra has been so devastating. Nicotinic acid is present in wheat and rice, but not in maize or oatmeal.

There is a tendency to prescribe vitamins in pure state, but such procedure should be for emergency only. The right way to take our vitamins is not in tablet form, but in a properly balanced diet providing minerals, protein, and other essentials in the form of fruits and vegetables, wholemeal flour, nuts and legumes, and in milk, butter, cheese, eggs, liver, and fish.

Methods have been devised for estimating the vitamin values of ordinary foodstuffs in terms of international units. A recent set of average figures is given in Mrs. Plimmer's "Food Values at a Glance." The daily vitamin requirements are known with fair accuracy. The requirement is proportionately higher during the growth period, pregnancy and lactation, and is increased by infective conditions. In the case of vitamin B<sub>1</sub> it has been estimated that a woman during pregnancy needs 900 to 1,500 international units daily as compared with 750 for the average adult. In febrile and other conditions as much as 1,500 international units are required. The allowance for infants and children is calculated at 40 international units per 100 calories of food.

These figures are optimum and far higher than the minimum required to prevent beri-beri. The average intake in this country is about half-way between the beri-beri level and a desirable optimum.

The need for vitamin C is increased during pregnancy, lactation, and fevers, and is relatively greater in children.

These facts were unknown during the last war and the health of the nation suffered from an insufficiency of the foods now classed as protective foods, and at the end of the war there was a severe outbreak of influenza and pneumonia.

A proper balance of the diet and an ample supply of vitamins are required as an everyday habit. A well-nourished body is resistant to infection and withstands stress and strain just like a well-built house resists the onslaughts of wind and rain. Plimmer writes, "It is absurd to provide an excess of bricks and not enough roofing tiles for a house, and it is equally absurd not to calculate the right amount of the various substances used for the construction and maintenance of the human body." Appetite will regulate energy requirements, but the supply of vitamins must be checked. The necessary information is available and it should be used. In order to secure proper nutrition the Ministry of Food is providing information as to foods so as to enable the people to choose the proper foods and ration themselves voluntarily. Experts on its staff have secured unlimited margarine, vitaminized with A and D, equal to the best summer butter and making the restriction of butter of no consequence. Milk is unrestricted and cheap supplies are available for children. Sugar is not a protective food and its restriction is considered beneficial by experts: they agree that too much sugar is eaten in normal times. Bread and potatoes are better foods than sugar.

In the last war cereals were milled to 90 per cent and over and bread was not rationed. In this war we are eating white bread and using just over 70 per cent of the wheat grain without any diluent. Modern scientific investigation of nutrition has made it quite clear that wholemeal bread is a more nourishing food than white bread, and it would be better for the nation's health to eat brown bread.

The Accessory Food Factors Committee of the Lister Institute and Medical Research Council have made four recommendations on bread. They suggest that flour for the bread of the people should contain the germ of the wheat grain, as much as possible of the aleurone layer, and the finer portions of bran.

Instead of flour consisting of about 70 per cent of the wheat grain as it does at present, the percentage extracted should be at least 80 per cent. By this means the content of certain vitamins, of all minerals, and of fat, would be increased.

If 1 lb. of bread be taken as the average amount consumed by an adult labourer, then the loaf made from white flour of 70 per cent extraction would give about 80-160 International units of vitamin B<sub>1</sub>, while that

made from 80 per cent extraction would give 300–450 International units, an amount equal to the total requirement of B<sub>1</sub> by an adult worker. Fat and fat-soluble vitamins and vitamin E would also be increased in the 80 per cent flour. Carotene (pro-vitamin A) would not be much increased as it is distributed throughout the grain and is present in the 70 per cent if this has not been bleached.

The second recommendation is that flour must not be bleached or improved by the use of oxidizing agents such as nitrogen chloride, nitrogen peroxide, chlorates, bromates, chlorine peroxide, or any other process which damages the nutritive value of the flour.

As regards minerals, the change to 80 per cent flour would give the daily requirement of 10 mg. of iron. The calcium would only be increased to 150 mg. against a daily requirement of 500 mg.; and milk, cheese and green vegetables, the foods rich in calcium, should be increased on a diet largely composed of bread.

The third recommendation is that the public would be benefited by the addition of calcium salts to the flour from which bread is made. This flour should be specially designated. The production and consumption of milk, cheese, and vegetables should at the same time be promoted to the maximum extent in order to secure an adequate supply of calcium.

The fourth recommendation is that baking powder which produces alkaline conditions and destroys vitamin B should be discouraged in making bread or biscuits.

Flours of high extraction, if coarsely ground, are not utilized so well by the body as the finer flour. For this reason extraction of 80 to 85 per cent was selected because it represents a fraction of the wheat grain in which improvement in the nutritive value is pronounced, but in which the decrease in utilization has scarcely begun.

In present conditions it is considered advisable that stocks of food should be scattered as widely as possible. Many of our flour mills are at the ports where the grain arrives, and if wheat is to be distributed quickly it must be milled first and stored elsewhere as flour. In so far as this is the case it must be stored in the form in which it keeps best.

The health aspect of the matter has been met by the Government ordering that wholemeal bread shall be available at the same price as white, thus removing the grievance of those who complain that they do not eat brown bread because it is too expensive. It should be legally specified that the wholemeal bread sold at the same price as white shall contain the nutritively valuable germ.

By ordering that white bread shall contain vitamin B<sub>1</sub> and calcium salts the Government have made good the two most serious deficiencies of white bread. Bread is the staple food of the poor, while its nutritive value is not of much importance to the well-to-do. The general consumption of bread and flour in the country is just over  $\frac{1}{2}$  lb. per head, but its distribution is very uneven. Better-off people average 4 oz. per day, whereas in the

last war some families doing heavy manual labour consumed  $1\frac{1}{2}$  lb. per head. The more carbohydrate is consumed the more vitamin B<sub>1</sub> is required, and the choice of bread as the vehicle so that the raising of one automatically increases the consumption of the other is a happy device.

It is not at present clear whether calcium is to be added to the wholemeal as well as to the white bread, but it would be well if it were so, for brown bread, though rich in B<sub>1</sub>, does not contain more calcium than white bread.

The present rationing of meat and bacon makes no serious difference to the intake of vitamins as there is a good supply of other forms of animal protein for those who can afford to purchase them. One gramme per kilo of body-weight, that is about 70 grammes of total protein per day, is the requirement for an adult man. At least half the protein should be of animal origin.





## Clinical and other Notes.

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### NOTES ON AN INTERESTING CASE.

BY CAPTAIN J. MACKAY-DICK, M.B., CH.B., M.R.C.P. EDIN.,  
*Royal Army Medical Corps.*

Edward P., aged 22, service three years, was admitted to Citadel Military Hospital, Cairo, on June 24, 1939.

He complained of (a) marked sweating localized to two well-defined areas. since April, 1938, and becoming progressively worse; (b) loss of weight for thirteen months; (c) wasting of certain muscles for thirteen months; (d) attacks of general weakness especially felt in arms and legs and experienced towards the end of the day for thirteen months; (e) grip and "carrying power" becoming progressively weaker for thirteen months.

*History.*—Prior to the onset of symptoms the patient had never complained of sweating, in fact he had "never noticed" himself sweating even in hot weather. Now in April, 1938, he noticed that he sweated profusely (a) in the region of the left side of the neck, including the left shoulder extending just below the insertion of the deltoid muscle, and also the upper part of the chest (*see* figs. 1 and 2); (b) on the right side of the back, including a small area on the left side (*see* fig. 2) and round the right side involving the hip and the right side of the lower abdomen but not extending as far as the mid-line. Now he sweats very little in each axilla and on the front of each thigh, but elsewhere the skin is dry and harsh even during the heat of the day in an Egyptian summer. In April, 1938, he was forced to change his shirt once a day. By the end of July, 1938, the sweating in those areas became much worse causing him to change his shirt two or three times daily. Just about that time he "started to feel run down." On the way out to Egypt in September, 1938, "sweat just poured from the sweating areas" forcing him to change his shirt three times during the evening. During the voyage he "seemed to get thin and he felt that he was losing strength." In May, 1939, he returned to England and at that time he found that he weighed 9 st. 9 lb. At the end of the month he again weighed himself and on this occasion he weighed 9 st. 6 lb. On the return voyage to Egypt the weather "was just warm" but he sweated so profusely in the localized areas that he was forced to change his shirt as many as five times in half an hour. At that time he noticed that his biceps muscles were smaller and that he was losing his "grip and lifting power." The attacks of weakness of which he had been complaining all this time occur towards the end of the day and he goes "all limp just as if he had had a very heavy day." Such attacks of weakness, mainly affecting the arms and legs, are sudden in onset and last for half to one hour, when they pass off spontaneously.

**Family History.**—Mother died, aged 34, from pneumonia. Father died, aged 38, from “stricture of the gullet.” Two sisters, aged 27 and 23 respectively, are alive and well. The elder is married and has four healthy children. As far as the patient knows his mother had no miscarriages.

**Previous illnesses.**—“Septic appendix” aged 8. “Slight fever” at Catterick, Easter, 1937. Mumps as a child. He fell from a ladder from a height of 20 feet and bruised his right side six years ago. He was not laid up with this and all that he suffered was a very large bruise on his right hip.

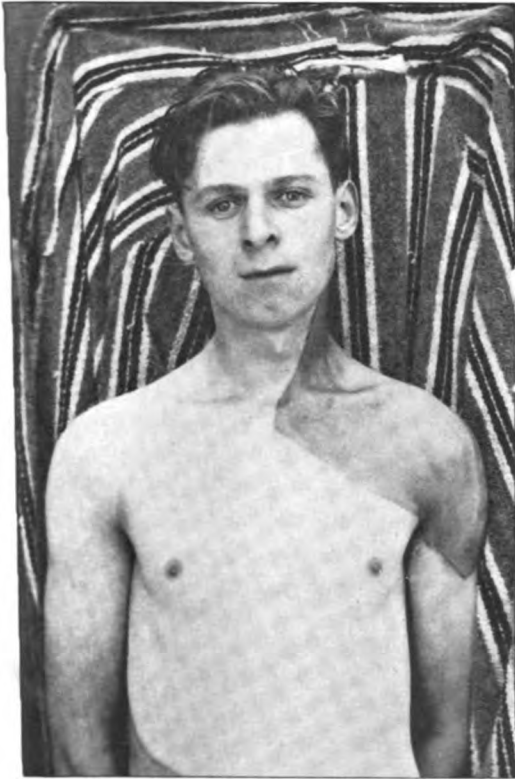


FIG. 1.—Note inequality of pupils (use hand lens), also area of hyperhidrosis (shaded area).



FIG. 2.—Shaded areas indicate areas of hyperhidrosis. Note also i, winging of scapula, and ii, scoliosis.

**On Examination.**—Temperature 98·6° F. Pulse 61. Respiration 18. Weight (July 1, 1939) : 8 st. 11 lb. 8 oz. The patient has a sallow complexion. He has a tired, listless, apathetic, and dull appearance. There are wrinkles in the forehead but his face is smooth, lacking in active expression, and the cheeks are drooping. There is slight bossing of the frontal bones.

**The skin :** There are two more or less sharply demarcated areas which are almost completely covered with a sweat rash and with beads of perspiration. The appearance is most striking, especially as the other areas of skin,

except the front of each thigh and to a lesser extent each axilla, are dry and harsh even in the heat of a very "sticky" July day in Egypt. The areas involved are shown in figs. 1 and 2. The appearance of these areas during the heat of the day has to be seen to be believed. There is a well-marked rash on each buttock but excessive sweating is not complained of here.

*Central Nervous System.*—The patient is right-handed. Speech is normal. Pupils: Marked inequality in size. They are not round. Left pupil: It is much larger than the right pupil. It is pear-shaped, just like a pear lying on its side with the narrow end pointing laterally. Its abnormal shape becomes most markedly accentuated when the pupil is contracted, i.e. when it reacts to accommodation, which it does very briskly. Right pupil: This is smaller than the left pupil but it does not appear smaller than normal. It is not round. The upper part appears a little flattened and the lower medial part bulges a little. Its abnormal shape is also markedly accentuated when it is contracted, i.e. when it reacts to accommodation, which it does briskly but not so completely as the left pupil. In other words, when both eyes accommodate the abnormal shape of each pupil is accentuated and, whilst previous to accommodation taking place the left pupil is much larger than the right pupil, the pupils are unequal in size, but this time the right pupil is larger than the left one.

Now when the patient is asked to look well into the distance the right pupil quickly regains its former size, but the left pupil enlarges very slowly and for a time it remains smaller than the right pupil. However, very gradually it dilates, becomes equal in size to the right pupil, and finally it regains its former size and becomes very much larger than the right pupil. The right pupil reacts very little, although definitely, to light, whilst the left pupil does not react to light at all.

The consensual response has been observed in the right eye but not in the left eye.

The effects produced when the following drugs were instilled into each conjunctival sac at intervals of several days were: (a) Homatropine hydrobromide 1 per cent: Both pupils dilated enormously. The right pupil appeared round but the left pupil appeared slightly elliptical. (b) Cocaine 2 per cent: The same effect as above with the exception that both pupils appeared round. This would appear to exclude synechiæ and iritis. (c) Adrenaline 1:4,000: No effect.

The left eye appears less prominent than the right eye and the left upper eyelid exhibits a slight degree of ptosis. There is no photophobia. Each cornea appears a little cloudy and there is a small zone of circumcorneal injection on the medial aspect of the left eye. The corneal reflex is definitely less brisk in the left eye than in the right eye. There is no nystagmus.

*Visual Acuity.*—R.V.  $\frac{6}{60}$ . L.V.  $\frac{6}{60}$ .

*Ophthalmoscopic Examination.*—Nothing abnormal noted.

*Epigastric Reflexes.*—Present, sluggish, and equal on both sides.

*Abdominal Reflexes.*—Present and equal in both upper quadrants but very brisk in both lower quadrants.

*Upper Extremities.*—Triceps jerk : Doubtful on each side. Biceps jerk : Doubtful on right side; absent on left side. Wrist jerk : Just elicited on both sides.

Wasting of biceps muscles especially on the left side (Rt. 10 in., Lt. 9½ in.).

Flexion at the shoulder is weakened on each side. The grip is also weakened on both sides. There is definite wasting of the small muscles of the hands.

There is winging of the scapulæ, especially on the right side. No fibrillary tremors. Stereognostic sense normal. No muscular inco-ordination. No paræsthesia or sensory impairment of any kind. No dysdiadokokinesia.

*Lower Extremities.*—Knee-jerks : Absent even after reinforcement tried. Ankle-jerks : Absent. Plantar response is flexor on each side. Bone vibration sense is normal. Muscle sense is normal. Joint sense is normal. No muscle inco-ordination. No fibrillary tremor. Romberg's sign absent. Sensation to light, touch, heat, cold, and pain, normal. No paraesthesiæ. Muscle wasting is obvious in left quadriceps extensor just above the left knee. Right side 13½ inches, left side 13 inches. Extensors and flexors of the left hip are feeble compared with those on the right side. The dorsi-flexors and plantar flexors of the left foot are feeble compared with those on the right side.

Cerebrospinal fluid : Clear colourless fluid under normal pressure. Cells : 2.5 cm. Protein : 20 mg. per cent. Sugar : 25 mg. per cent. Chlorides : 725 mg. per cent. Wassermann reaction negative. Lange's colloidal gold test, 0000000000.

*The Skeleton shows the Following Abnormalities.*—(a) On inspection : (i) Bossing of the frontal bones, (ii) high palatal arch, (iii) slight irregularity of spine in upper cervical region with slight cervical lordosis, (iv) scoliosis.

(b) On radiological examination :—

(1) *Cervical Spine.*—The first rib on the right side is rudimentary. There is synostosis of the neural arches of the second and third cervical vertebrae. The vertebral bodies are also fused, their original outline is visible at their junction.

(2) *Thoracic Spine.*—Spina bifida of the first dorsal vertebrae is present. The transverse process on the left side is enlarged and irregular.

(3) *Lumbar Spine.*—There are six lumbar vertebrae and a thirteenth rib is present on the right side. There is sacralization on the left side of the lumbar spine. There is calcification in arteries above and in front of the hyoid bone.

*Alimentary System.*—Appetite good. Daily motion of the bowels. The teeth appear poorly developed. They are dirty and a few are carious. No notching of central incisors, but some teeth show a tendency to narrowing towards the cutting edge. The palatal arch is high. Tongue, furred but shows no fissuring or other abnormality. Liver not palpable.

*Renal System.*—No symptoms. Urine : Reaction acid, albumin nil, sugar nil, deposit nil.

*Hæmopoietic System.*—No pallor of mucous membranes although the face looks pale and pasty. Spleen not enlarged. Lymph glands: Both tonsillar glands are painlessly enlarged. There are a few discrete painless palpable glands in the axillæ and in the groin.

R.B.C. 4,450,000; Hb. 80 per cent; C.I. 0.9. Total white count. 10,200 c.mm. Differential white count: Polymorphs 51 per cent; lymphocytes 41 per cent; large mononuclears 4 per cent; eosinophils 4 per cent. Blood sedimentation rate 12 (Westergren). Blood sedimentation rate (August 10, 1939), 5. Wassermann reaction: Negative after provocative injection of "914".

*Cardiovascular System.*—Pulse: 61, regular in time and force. Blood-pressure 114/70. Vessel wall not palpable. The internal carotid arteries show medial calcification and are palpable for a short part of their course in the neck. No other superficial or relatively superficial vessels are palpable. Heart: Not enlarged. Apex beat in fifth interspace just internal to the nipple line. Sounds are pure. There are no murmurs of cardiac or of cardio-respiratory origin.

*Respiratory System. Thorax and Neck.*—There is a fullness just above the inner end of the left clavicle. This is a soft swelling and appears to be due to the scalene muscles which are more prominent on the left than on the right side. There is a slight irregularity at the upper part of the cervical spine and this corresponds with the area overlying the second and third cervical vertebræ which show fusion. In addition there is a scoliosis. Poorly clad chest wall.

Chest expansion,  $2\frac{1}{2}$  inches. The pectoral muscles show myotatic irritability. Vocal fremitus and vocal resonance are normal. Bilateral vesicular breath sounds with no accompaniments.

*To Summarize the Case Exhibits:—*

- (i) Bossing of the frontal bones.
- (ii) High palatal arch.
- (iii) Medial calcification affecting areas of each internal carotid artery bilaterally and symmetrically.
- (iv) Skeletal congenital abnormalities, viz.: Synostosis of the neural arches of the second and third cervical vertebræ. The vertebral bodies are also fused but their original outline is visible at their junction. Slight cervical lordosis. Scoliosis. A rudimentary first rib on the right side. Spina bifida of the first dorsal vertebra, the left transverse process of which is enlarged and irregular. Thirteenth rib on the right side. Six lumbar vertebræ with sacralization on the left side.

(v) Progressive loss of weight in spite of excellent appetite, highly nourishing diet, and cod-liver oil and malt: Early May, 1939, 9 st. 9 lb.; late May, 1939, 9 st. 6 lb.; July 1, 8 st. 11 lb. 8 oz.; July 30, 8 st. 6 lb.; August 5, 8 st. 4 lb. 6 oz.; August 13, 8 st. 2 lb. 3 oz.

(vi) Wasting of various muscles due to lesions of the anterior horn cells in the corresponding segments of the spinal cord.

(vii) Well-defined and localized areas of hyperidrosis as well as abnormalities of the pupils. Actually some areas of the skin, i.e. the axillæ and the front of each thigh, sweat less than normally, and the remainder of the skin surface does not sweat at all, even during an Egyptian summer.

(viii) The cerebrospinal fluid is normal.

(ix) The Wassermann reaction of the blood and of the cerebrospinal fluid is negative.

(x) No evidence of involvement of the white matter of the spinal cord or of the fibrils for pain and temperature which cross to the opposite side of the cord, or of the posterior horn cells, the posterior roots, or the posterior nerves.

(xi) Blood-pressure 114/70.

#### DISCUSSION.

In the presence of so many bony lesions which are regarded as congenital abnormalities one is tempted to believe that the lesion on the spinal cord, resulting in the lower motor neurone lesions with the patchy irritation of, as well as the possible destruction of, the sympathetic in certain areas, is also congenital in origin.

Accordingly I would suggest that the neurological condition is exclusively one of syringo-myelia, even in the absence of pyramidal tract involvement and even in the absence of the main diagnostic sign, *par excellence*, of that disease, namely dissociated anæsthesia. There is no doubt that the lesion, causing the neurological signs and symptoms, involves only the grey matter of the spinal cord, and is affecting exclusively the anterior horn cells and the sympathetic outflow, but in no way affects the posterior horn cells, etc.

Moreover the bilateral and symmetrical medial calcification of, at first, part of the internal carotid arteries is extremely interesting, and at least four questions must be asked concerning the presence of Monckeberg's sclerosis, namely: (i) How long has it been present? (ii) Is it merely a coincidence and, if so, has it ever been described in such a young subject? (iii) Is it part of the general pathology of this complex case. Or, (iv) Is it a signal and an indication that the changes in the grey matter of the spinal cord are vascular in origin?

Conceivably an irregular patchy vascular degeneration involving exclusively the blood supply to the grey matter of the spinal cord could result in: Gradually progressive ischaemia causing degenerative changes in the grey matter of the spinal cord with accompanying gliosis and subsequent cyst and cavity formation. I wonder if the entire arterial tree has ever been investigated radiologically in early established cases of syringo-myelia?

I realize that the appearance of the patient is suggestive of congenital syphilis, but the cerebrospinal fluid is normal, the Wassermann reaction of the blood and of the cerebrospinal fluid is normal, even after a provocative injection of "914". The ocular fundi are both normal and the patient is of average intelligence.

I realize that congenital syphilis is an uncommon cause of mental deficiency and that the Wassermann reaction tends to die out after puberty in congenital syphilis. In addition, as regards the diagnosis of syphilis, I also realize that the Wassermann reaction must be regarded only as a laboratory aid and not as the highest court of appeal. However, if this were a case of congenital syphilis I would have expected to find some hint of this in the cerebrospinal fluid, in the ocular fundi, and possibly the presence of Argyll Robertson pupils. The left pupil in this case is enlarged, it is not round, and it does not react to light, but it does react to accommodation, briskly and fully, when its abnormal shape becomes markedly accentuated. Such pupils, I have read, may be found in cases of (i) multiple sclerosis, (ii) syringo-myelia, (iii) spina bifida, (iv) injury to the spinal cord, (v) anterior polyomyelitis, and in (vi) abiotroplasias.

This type of pupil is *not* an Argyll Robertson pupil. This type of pupil, which is mostly demonstrated in cases of syphilitic involvement of the central nervous system, whether the disease is active or latent, and which may also be demonstrated but rarely in very special cases of brain tumour and of encephalitis lethargica, shows the following characteristics: It is a *small* pupil, irregular in outline and, like the left pupil in the case under discussion, it reacts to accommodation but not to light.

Another condition which must be mentioned to be excluded is the Holmes-Adie syndrome characterized by (a) small tonic pupils which at first sight do not appear to react to light and to accommodation, but which *do* react very very slowly to both light and accommodation, and (b) absent tendon reflexes.

Other conditions which must be excluded are: (i) Progressive muscular atrophy, but the presence of the sympathetic involvement, the absence of fibrillary tremor, the age of the patient, and the associated congenital conditions render this diagnosis improbable; (ii) intra-medullary neoplasm, which is mentioned merely to exclude it at once.

Trauma has been mentioned as a cause of syringo-myelia, but it is unlikely that the injury sustained six years ago is in any way responsible for the lesion in the grey matter of the spinal cord.

I do not consider that any of the bony lesions are in any way responsible for the neurological manifestations.

This is a most interesting case with its numerous congenital bony abnormalities, the Monckeberg's sclerosis and the apparent lesions in the grey matter of the spine and involving, irregularly and exclusively, the anterior horn cells and part of the sympathetic outflow. I suggest that it is a case of syringo-myelia, with which condition congenital abnormalities of the skeleton are not infrequently associated. It is difficult to explain the presence of the medial calcification of part of the internal carotid arteries on each side, and I suggest that it would be interesting to investigate as thoroughly as possible the entire vascular tree in established cases of syringo-myelia.

## ACKNOWLEDGEMENTS.

I wish to thank Colonel (now Major-General) P. S. Tomlinson, D.S.O., M.R.C.P., late Deputy Director of Medical Services, British Troops in Egypt, and the Officer Commanding the Citadel Military Hospital, Cairo, for permission to send this case for publication. Also Captain (now Acting Major) G. C. Dansey-Browning, D.O.M.S., Army Ophthalmic Specialist, for collaborating in the ophthalmic examination. I am especially indebted to Major (now Lieutenant-Colonel) W. S. Evans, R.A.M.C., formerly Radiologist, B.T.E., without whose expert assistance and suggestions many of the congenital abnormalities presented by this case would not have been discovered.

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## ROAD MOVEMENT BY FIELD AMBULANCE ON CONVOY.

BY MAJOR R. A. STEPHEN,

*Royal Army Medical Corps.*

THE field ambulance to which I was posted arrived in France during mid-September, 1939, and during the succeeding months travelled in convoy over many hundreds of miles. In the early days most of us had had little or no experience of convoy work, and we made mistakes due to inexperience. Since then, however, we have improved our efficiency a great deal as a result of experience, and feel that the following notes may prove of assistance to others who have not had that experience, and so save discomfort to all concerned.

We were exceedingly fortunate in the R.A.S.C. personnel attached to us. Many people think that the convoy work is entirely their responsibility, but that is far from the truth. The whole unit must be trained in their duties, and be fully aware of what they must do.

Before a move, everything must be fully worked out in minute detail.

*Loading Lorries.*—Personnel to travel in each vehicle should be detailed by name beforehand. They should load the lorry without assistance, and should know exactly what the load is. Stores should be loaded in such a way that things which will be required on arrival at the destination are at the rear of the lorry.

Before leaving England, a neighbouring infantry unit very kindly built up a skeleton framework on the sides of our lorries, and this greatly added to their capacity.

If the rear part of the lorry is loaded so that bales form seats for the occupants, they have a much more comfortable journey. The personnel should have one of their blankets available, and their waterproof sheet can be hung at the back of the lorry, as a protection from the weather. As much loading as possible should be done the night before.



After arrival in France, the R.A.S.C. built superstructures on the lorries to support the tarpaulins. These were made of lengths of wood measuring 3 by 2 inches, and were filled in with thin slats. To enable vehicles to travel by rail, these superstructures must not be higher than 10 feet from the ground at the centre, and slightly less at the sides. The optimum height is 5 feet from floor level to centre ridge pole.

*Carriage of Personnel.*—Companies : These can be carried in the company lorries plus a 3-ton lorry with water trailer, attached for moves from H.Q. The advantage of having personnel on the lorry carrying the water trailer is that if for any reason the lorry has to be reversed, or turned round, the personnel can man-handle the water trailer. This is essential if the ground is soft.

H.Q. Company requires a bus to carry at least twenty personnel. If the unit is at full strength, a second bus would be required, but, with casualties, men on leave, and in advance parties, etc., one bus is sufficient. In actual practice, any men left over can, at a pinch, be put in an ambulance. The ambulances likely to be used for carrying any injured *en route* must of course be left empty.

*Drivers, R.A.M.C.*—War establishments allow of a fixed percentage of spare R.A.S.C. ambulance drivers, but occasions may arise where one of these is not immediately available to replace a battle casualty during evacuation. We selected experienced drivers from amongst our nursing orderlies and posted these on duty as wagon orderlies so that they could bring in their ambulances if the R.A.S.C. driver had been killed.

*March Discipline.*—This must be explained in detail to each driver. In the early days, drivers must be shown the exact distance, by practical demonstration, which they must maintain between vehicles to keep the correct road density. This is one of the most vital points in convoy work.

Much can be done to prevent bunching of vehicles if the difficulties are explained beforehand to the drivers. If a road twists a lot, each driver should be very alert on rounding a bend so that he can stop at once should he see the vehicle in front halted. This allows the vehicle behind him to stop short of the bend.

Drivers in the front of the column must appreciate the importance of maintaining the speed laid down for the convoy. Some are inclined to go slowly in second gear for a time, and then speed up for a mile or two to relieve the monotony. This is very upsetting for the vehicles in the rear as the increased speed is exaggerated all down the column.

The necessity for correct spacing is, of course, obvious. Bunching up asks for bombing, whereas well-spaced vehicles are not likely to attract fire. Bunching at dispersal point is very frequently seen unless active steps are taken to prevent it. The passage of aeroplanes down a column brings the significance of those points home very forcibly.

Sketch maps of the complete route should be in the possession of each driver before starting. The N.C.O. in the cabin with him can then direct him.

*Loads—Dental Van* (during convoy work only).—The 12-cwt. dental van is a most useful vehicle. During moves it is a great asset to have it travelling empty and placed near the Q.M.'s car so that the Q.M. can slip out of the convoy and collect supplies, rations, coal, straw, etc. If the Q.M. has not an empty vehicle available at short notice he will be greatly handicapped in the performance of his duties.

Should the unit halt for an hour about mid-day this van can be taken to the cook's lorry to collect the hay boxes and pass along the length of the column distributing hot tea or a hot meal. One has only to experience convoy work in mid-winter to appreciate the value of this. A larger vehicle is not permitted to move during a halt.

*Alteration to Loading Tables.*—Our unit was fortunate in having 2-ton impressed vehicles issued in lieu of 30-cwt. Having the sides built up with wooden framework enabled us to distribute the equipment and clothing over the company and stores lorries. This left more space in the baggage lorry, which was used by the quartermaster, the serjeants' mess, and the H.Q. clerks.

*Cars.*—It is essential to have all the officers with maps of the route evenly distributed through the column in small cars which can move about the column if necessary and investigate delays, etc., without blocking up the roads. One car must lead the column, and as this is liable to strike a road mine it should not be the C.O. Each medical officer should have a first-aid outfit in his car. The transport officer should be in the rear as he can then deal with any vehicle casualties.

All officers must be prepared to take the initiative in clearing up local stoppages. They should watch the route carefully during the whole journey, checking up each road junction on the map as they pass, so that if a driver takes a wrong turning it is spotted at once. Following vehicles can then be directed along the route without loss of time.

*Ambulances.*—Like the cars, these should be distributed through the column near M.O.s so that they can be used for collecting casualties without causing delay. In practice, the six-wheeled ambulances are by far the best vehicles in a field ambulance for pulling out ditched vehicles.

*Cooks' Lorries.*—These should travel with a hot meal ready, if possible, and be placed centrally so that the maximum number of personnel have the minimum distance to walk to reach it.

*Technical Stores.*—As far as possible these should again be distributed through the column so that if half the unit is cut off the remainder can still function.

*R.A.S.C. Store Lorry.*—This is a heavily laden vehicle, and is of no use for hauling out ditched lorries. It should be third from the end with a towing ambulance behind it for this purpose.

*Motor Cyclists.*—These are invaluable men. They have the hardest job in the convoy and cover twice the mileage of anyone else. Every consideration for these men should be shown.

The Serjeant-Major R.A.S.C. on a motor-cycle should supervise the march discipline of "A" and "B" Companies in front. His best position is behind the leading car, along with the two company dispatch riders. In that position he can post dispatch riders at difficult corners, forks, etc., as convoy directors. The Serjeant R.A.S.C. supervises the march discipline of H.Q. Company vehicles and his travelling position is behind the C.O.'s car with the H.Q. dispatch rider.

When the C.O.'s car reaches the company dispatch rider on point duty directing the convoy, the H.Q. dispatch rider should take over from him to allow him to reach the head of the column as soon as possible. This evens out the mileage per dispatch rider.

I am indebted to my fellow-officers in the field ambulance for their assistance in compiling these notes.

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## Echoes of the Past.

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### NOTES ON THE MEDICAL SERVICES DURING THE CIVIL WAR AND THE INTERREGNUM, 1642-1660.

BY THE LATE LIEUTENANT-COLONEL G. A. KEMPTHORNE, D.S.O.,  
*Royal Army Medical Corps (R.P.).*

THE period between the union of the Surgeons and Barber Surgeons of London in the last years of the reign of Henry VIII and the death of Charles II in 1685 marked a definite epoch in the history of British surgery. Richard Wiseman, the last of the great naval and military surgeons of these times, was the successor of such men as Gale, Harman, Halle, Clowes, and Woodall who, as members of the Company, strove to put surgery on a scientific basis, organized systematic teaching lectures and examinations, and laid stress on the need for a preliminary general education before embarking on a surgical career. Their aim to raise the professional status of the surgeon to that of the physician and to suppress quackery met with much success, though it only lasted their lifetime.<sup>1</sup>

In the seventeenth century surgeons desiring to practise in London required a licence from the Bishop or Dean of St. Paul's, which was only granted after an examination conducted to their satisfaction by persons of the surgical faculty. No one might practise before he was free of his apprenticeship (usually seven years), and no one was granted the freedom of the Company before he was 21.

These strict rules, however, could hardly have applied to provincial surgeons, and there is reason to suppose that in time of war, when surgeons

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<sup>1</sup> See D'Arcy Power. "A Short History of Surgery."

were required for the levies, and we hear of surgeons being themselves impressed, no great proof of skill was demanded.

In the troops raised for the invasion of the Palatinate in 1620 each regiment had a surgeon, in addition to whom there were twelve company surgeons. These last could have been little more than dressers and chiropodists, but some of them no doubt rose to be regimental surgeons or were accepted as such by the King or the Parliament during the hurried mobilization which preceded the Civil War. Elton, in "The Complete Body of the Art Military (1659)," quoted by Colonel Clifford Walton, wrote: "In every company there ought to be a barber surgeon for the trimming of soldiers who ought likewise to have some skill in chirurgery. . . . He is free from duties belonging to the company, and in some places is allowed to be an officer, which I conceive it ought so to be in respect they allow but of one chirurgeon to a regiment."<sup>1</sup>

During hostilities, surgeons as such seem to have been usually treated as non-combatants enjoying privileges defined by custom rather than by any positive regulation.<sup>2</sup> After a battle, as now after a railway accident, local assistance was provided by the neighbouring medical practitioners to the wounded of both sides impartially, and the casualties were removed in wagons to the nearest town and left to the care of the inhabitants. Following the battle of Newbury in September, 1643, the King gave special orders regarding the wounded prisoners that, though they deserved the punishment of traitors, "yet out of our tender compassion you are to provide for their recovery as well as those of our own Army." When the Royalists were driven out of Nottingham, the wounded, in the absence of other adequate arrangements, were brought to Mrs. Hutchinson, the Parliamentary governor's wife, "and she having some excellent balsams and plasters in her closet, with the assistance of a gentleman who had some skill dressed all the wounds with such good success that they were all well cured in a convenient time."<sup>3</sup> She treated the Royalist wounded with equal humanity.

In the first few months of the war, when the troops engaged were largely untrained militiamen, neither side seems to have showed any marked hostility to the other or any particular desire for a fight *à outrance*. As the professional element became more prominent, battles were fiercely contested, and some of the wounds caused by round shot and cavalry sabres were, from Wiseman's account, sufficiently horrible.

The majority of the more eminent physicians and surgeons of the day, whatever their political views, probably continued their practice undisturbed. When the Queen was seriously ill at Exeter on her flight to France in 1644, her favourite physician, Sir Theodore Mayerne, at the King's urgent request, visited her from London, though his sympathies seem to have been on the

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<sup>1</sup> "History of the British Standing Army."

<sup>2</sup> Sir J. Firth, "Cromwell's Army."

<sup>3</sup> Memoirs of Colonel Hutchinson.

other side. But among those who adhered closely to the Royalist cause are some well-known names.

**WILLIAM HARVEY.** The distinguished physiologist, then in the height of his reputation, and a man of 64, accompanied the King as physician in ordinary when he raised his standard at Nottingham, and remained with the court at Oxford till the town fell to Fairfax in 1646. During the undecided battle at Edgehill (October 23, 1642) he was in charge of the two young princes. He described how he withdrew under a hedge and started to read a book, but had not read long before a bullet of a great gun grazed on the ground near him which made him move his station.<sup>1</sup> While at Oxford, he was presented to the wardenship of Merton College. He died in 1657.

**RICHARD WISEMAN.**—For the details of his career we owe much to the researches of Sir Thomas Longmore, of our own Service. He was probably born in 1622 and served his apprenticeship in the Dutch Navy. Judging from his writings, he joined the Royalist army in the third year of the war, served as surgeon during the capture of Weymouth and its recapture by the Roundheads in February, 1645, at the siege of Taunton, and in the final stages of the war in Cornwall, where he attracted the attention of the Prince of Wales. When, shortly before Lord Hopton's surrender at Tresilian Bridge, the Prince embarked for Scilly, Wiseman accompanied him, and remained his constant attendant in Jersey, France, and Holland for the next four years. When in 1650 Charles landed in Scotland, he took with him Alexander Frazier as physician, Wiseman as surgeon, and Mr. Chance as apothecary. Wiseman was present during the fighting there, and at the final defeat at Worcester (September 3, 1651). Frazier escaped from the field, but Wiseman and his assistant William Clarke were captured while attending to the wounded. He was held prisoner for some months at Chester when his services were requisitioned for the wounded of both parties. At the end of the year he was allowed to proceed to London where, either from his high professional reputation, or because of his political unimportance, he was treated by the authorities with reasonable consideration, secured the freedom of the Company of Barber Surgeons, and acquired a large practice round the Old Bailey. He was at one time under suspicion of plotting the escape of a Mr. Read from the Tower, when he was again under arrest.

Wiseman left England about three years before the Restoration, and, like other Royalists, joined the Spanish Navy, Spain being then at war with the Commonwealth. In 1660 he came home, was appointed personal surgeon to Charles II and, on the first vacancy, serjeant-surgeon. Soon after, he began to suffer from hæmoptysis, and being debarred from active work commenced to write his "Observations," which in the next fifty years went through seven editions. He survived till 1676, was twice married, but left no direct descendants.

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<sup>1</sup> Aubrey. *Memoirs*.

As a surgeon, Wiseman is described as bold but prudent. His views on primary amputation are believed to have been a departure from the hitherto accepted ones. "Consider well the Member, and if you have no probable hope of Sanation, cut it off quickly while the Souldier is heated and in mettle. But if there be hopes of Cure proceed rationally to a right and methodicall Healing of such Wounds ; it being more for your Credit to save one Member than to cut off many."

Could he have relied on the support of his colleagues, he stated he would have performed laparotomy for the arrest of internal hæmorrhage. One sometimes wonders whether the gruesome spectacle of the evisceration of persons convicted of high treason, the last case of which is described in D'Israeli's account of the Babington conspiracy (1586),<sup>1</sup> conveyed any useful impression to surgeons as to the toleration of the abdomen to surgical interference. In the case described, the victim, who suffered at the hands of an unskilful barber, stood the operation for half an hour before he succumbed. Abdominal surgery is said to have been practised in Paris in the thirteenth century before the eclipse of the art in the late Middle Ages.

Among other royalist adherents may be mentioned SIR ALEXANDER FRAZIER, F.R.C.P. (1610-81), RICHARD PYLE, later serjeant surgeon to Charles II, WILLIAM CLOWES, THE YOUNGER (1582-1648), and ROBERT BROWN, the distinguished botanist, who fought as a combatant. On the parliamentary side, THOMAS SYDENHAM fought as a cavalry captain, and the DE BOATE brothers, distinguished not only as physicians but as Hebrew scholars, were with Cromwell in Ireland.

#### THE ARMY OF THE PARLIAMENT.

During the early stages of the war both sides were hampered by having to employ the militia to fight their battles. This force, the direct descendant of the General Levy of Saxon times, though organized into train bands by the Tudors, was not efficiently armed, trained, or disciplined. Its maintenance in peace was a charge on the counties, and legally there were limits both to its employment out of its own area and the length of time men might be retained with the colours.

The King's forces were, however, supplemented by regiments raised and maintained by his supporters, and Parliament followed suit by appointing commissioners to raise regiments by voluntary enlistment and later by impressment. Until the organization of the New Model in 1645, there was no military commander-in-chief of the Parliamentary Armies, of which at one time five were in existence operating independently under the direction of a committee.

In these armies two or three medical officers were attached to the staff and were responsible for the supervision and control of the medical administration, the chief of these being the Physician-General. How far the regi-

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<sup>1</sup> "Curiosities of Literature." Globe Edition, p. 240.

ments were provided with properly qualified surgeons is uncertain. Sir Charles Firth, our main authority, says that those engaged received 4s. a day, which was insufficient to attract men of much ability. It would appear from the numerous payments to general practitioners that casualties after an engagement were constantly left in the hands of local doctors. If an important officer was sick or wounded, the usual procedure was to send down a doctor from London to see him. In the Earl of Essex's army which fought at Edgehill in 1642, captured Reading in 1643, and surrendered to the King in Cornwall in 1644, the Physician-General was a Dr. St. John and the Surgeon-General Lawrence Lowe. Thomas Trapham, surgeon to General Skippon's regiment in this force, who in October of that year petitioned Parliament for an improvement in the treatment of Army surgeons, rose to some distinction. He was Surgeon-General to the Officers of Horse in Cromwell's Irish Army and later held an appointment in the Savoy Hospital in London. Dr. Henry Glisson was Physician to Lord Manchester's army engaged in the second battle of Newbury (October 27, 1644). His more famous namesake, Francis Glisson, Regius Professor of Physic at Cambridge, who happened to be in Colchester when besieged by Fairfax in 1648, tried unsuccessfully to obtain some mitigation of the terms of surrender. When Cromwell first held an independent command in 1644-45 his physician was Dr. John Waterhouse, whom he later recommended for the Oxford M.D. His Surgeon-General in Ireland was James Winter.

#### THE NEW MODEL.

In February, 1645, Sir Thomas Fairfax was appointed Commander-in-Chief of the united Parliamentary Armies, the establishment of which was fixed at 10 regiments of infantry each 1,000 strong, 11 of horse (600), 10 companies of dragoons (100), and the train, which included also two regiments of infantry and two companies of firelocks. The Chief-of-Staff was Major-General Skippon, and Oliver Cromwell was Lieutenant-General of Horse. Attached to the Headquarters were two physicians, Drs. Payne and Stranhill, and an apothecary, Master Webb.

Medical affairs remained in the hands of two commissioners, who were responsible for the treatment and disposal of sick and wounded men and the provision of physicians and surgeons. Civilian practitioners continued to be constantly employed, their bills, in whole or in part, being apparently met by stoppages from the patients' pay. The bill of George Blagrove (a Reading name), quoted by Colonel Clifford Walton, contains such items as "Richard Becke of Liefftenant Corsnall's, a very scalded foot 5s. John Bullock of Captain Barton's, a very sore cut on the forehead of his head which caused a peace of his scull the breadth of half a crown peace to be taken forth, also a very sore cut over the hand, £1 10s."

The only permanent hospitals available in London were Barts, St. Thomas's, and Bethlem. These were called upon to provide beds, but the accommodation was very limited. About 1644 the Commissioners established

two hospitals of their own, one at the Savoy, the other at Ely House. They provided for no more than 350 patients. Others were afterwards provided on a similarly small scale in Scotland and Ireland. The nurses were usually the wives or widows of soldiers. Their maintenance came largely from special excise duties. An order made February 14, 1646, states that the wounded in the Savoy Hospital must pay to Dr. Alexander Gourden, who has by the direction of the Committee attended them since the beginning, for his pains and care 6/8 per day.<sup>1</sup>

After the battle of Naseby (1645), doctors were sent down from London and provision made for the care of the wounded in Northampton and the villages round. After the recovery of Bristol in the same year, a large house was adopted as a hospital and patients were boarded out in the same way. The local hospitals, so called, must at this time have been purely alms houses for the reception of the aged and infirm.

The provision made for maimed and disabled soldiers who could not support themselves was at first regarded mainly as a matter for private charity. Collections and appeals for clothing were made in the London churches and the churchwardens handed over the now discarded surplices of the Anglican clergy to make linen bandages. But it was soon realized that Government action must be taken. The legal responsibility for the destitute under the Elizabethan Poor Law was on the parish authorities of their place of settlement. Parish rates were first fixed, and later the counties were assessed. From time to time during the Commonwealth special sums were voted, notably from money paid by the purchasers of confiscated royalist estates. After the expulsion of the Long Parliament, there is evidence that the hospital at Ely House, like Chelsea in after years, became a centre where claims were dealt with. There was a limited number of in-pensioners, others became out-pensioners. The organization for the Navy, which was possibly better off in this respect than the Army, was detailed in an order of 1652 that seamen should be retained on full pay till cured or their pensions settled.

The money available for these hospitals varied much with the internal political situation. Just before the Restoration, grants were much in arrear, and the soldiers in the Savoy were reported "in great distress and likely to perish through imprisonment, cold, and nakedness." In contrast to this, in July, 1653, the sum of £700 was paid to Richard Malbone for his expenses in conveying 220 invalids to Bath for their cure. These were selected from the patients at the Savoy and Ely House by Thomas Trapham the surgeon and James Rand the apothecary.

The diseases most evident during the Civil War are stated by Willis, a contemporary writer, to have been typhus and malarial fevers. Plague was prevalent in Holland at the time, and cases are said to have occurred in the garrisons of Wallingford and Dunster Castle.

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<sup>1</sup> Calendars of State Papers Domestic.



## THE WARS OF THE COMMONWEALTH.

The year of the King's execution (1649) was the first year of Cromwell's campaign in Ireland which was being used by the Royalists as a base for the invasion of England. In 1650 Fairfax resigned his post of Commander-in-Chief and Cromwell, now head of the Army, defeated Leslie at Dunbar (September 3, 1650), and Prince Charles at Worcester (September 3, 1651). He became Protector in 1653, having ejected the Long Parliament the previous year. In 1652-54 we were at war with Holland, and later with Spain.

On his appointment to the command in Ireland, Cromwell took particular pains to ensure his soldiers' well-being. Proper clothing was provided: in June the State Papers record the despatch of spices, sugar, oil, and confectionery for the Dublin hospitals, while surgeons' chests costing £25 apiece were issued to all units. In July £430 was paid to Marmaduke Lynne, the Apothecary-General, for 200 hospital beds. The war was a savage and ruthless one, but the English troops were well looked after as well as well led.

Cromwell crossed the Scottish Border on September 3, 1650, and marched on Edinburgh, but his movements were almost at once hampered by a serious epidemic of dysentery which nearly wrecked the campaign. Five hundred cases were embarked from Musselburgh and Leslie, his opponent, realizing the situation, avoided an action. Compelled by sickness and lack of supplies, the English army fell back on its ships at Dunbar, where, on September 1, Cromwell found his 16,000 men reduced to 11,000. Leslie had only to await events, but, overruled by his civilian advisers, he came down from the hills and suffered a disastrous defeat. There were 10,000 prisoners, about half of whom were released. The remainder were despatched to Newcastle through a district bare of all supplies. Many died from eating raw cabbages at Morpeth, many more of pestilence in Durham. The feeding of troops in country districts was difficult enough at all times, and prisoners came off badly, especially when the inhabitants were hostile. The incident recalls the fate of Essex's infantry who were allowed under the convention made after the battle of Lostwithiel in the autumn of 1644, to retire into Dorsetshire. Stripped in many cases of their uniforms and even of their boots, they marched for three days without food or shelter through the rain, slept in fields and lived on water till they crossed the Tamar. Of the 6,000 who left Fowey only 1,000 lived to enter Poole. The rest had died of starvation, disease, wounds, or exposure.<sup>1</sup> Heriot's Hospital, an orphan asylum, was adopted as a military hospital for the English wounded brought in to Edinburgh, and was so used by the garrison during the next eight years. Infantrymen admitted were stopped 1s. a week and troopers 2s. A report made in 1651 by Drs. Lawrence Wright and George Bate, sent from London to attend Cromwell in Scotland, mentions the acute shortage of doctors with the Army. The same year, the pay of the surgeons was raised from 4s. to 6s.

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<sup>1</sup> Coate. "Cornwall in the Great Civil War."

Meanwhile, detachments of soldiers had constantly been embarked on Admiral Blake's ships engaged with Rupert's privateers, and in July, 1652, the Dutch War began. Accommodation for the heavy casualties brought into port by the men-of-war was found in billets and hired buildings in the coast towns. The arrangements were in the hands of Dr. Daniel Whistler, an Oxford professor of note, who wrote a work on rickets. There was a naval hospital at Deal, and in 1653 he recommended another to be opened at Porchester Castle. The same year he received £150 for medical attendance on Admiral Blake.

The organization of the campaign in the West Indies was in striking contrast to that of the Irish expeditionary force. In April, 1655, drafts of undesirables weeded out of various regiments with volunteers from home and the Plantations attracted by the prospect of loot arrived off the city of San Domingo in the Island of Hispaniola under Admiral Penn and Colonel Venables. Arms, equipment, and supplies were all deficient, and though for several years we had had colonies in Bermuda and Barbados, and climatic conditions must have been known, no special provision was made to meet them. Landed thirty miles from its objective, without water bottles or adequate rations, and already weakened by dysentery, a column was launched into the tropical jungle. The advance guard was ambushed, the Adjutant-General who commanded it ran away, and his men not unnaturally followed his example, disorganizing the main body, which was withdrawn with difficulty and heavy loss to its base. Recriminations between the naval and military commanders followed. Food had run short, and the Admiral, according to Venables' account, refused to lend any. Finally, having consumed all the horses, asses, and dogs in the camp, the troops re-embarked. That at least some kind of sick transport was provided we gather from the court-martial sentence on Adjutant-General Jackson who, having had his sword broken over his head, was ordered to swab the decks of the hospital ship. Here, it is said, the wounded lay for forty-eight hours unfed, undressed, and unattended, while maggots hatched out in their sores.<sup>1</sup>

The expeditionary force next landed in Jamaica, which was occupied with little difficulty. Here the troops were soon dying from yellow fever at the rate of twenty a day—the fate of tens of thousands of others during the next two centuries—but the island was held.

The soldiers employed in this expedition were definitely of an inferior type, nor was their behaviour beyond criticism: but they were tried beyond endurance. Cromwell's army as a whole, by its conduct and discipline, won the respect of the nation, and the private soldier held a position in society which he is only now recovering. His steadfastness and gallantry in Flanders during the Spanish War were the envy of Europe.

During the Flanders campaign the unsatisfactory policy of quartering

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<sup>1</sup> Campbell. "Lives of the Admirals."

the sick and wounded on the inhabitants at the port of disembarkation was pursued. Following the battle of Dunkirk Dunes in May, 1658, they were landed at Dover and Harwich. A subsequent petition from the widow of the Mayor of Dover stated how her husband had met the convoys and provided for their disposal "enduring their most noisome scents and smells which hired servants would not, which encouraged the inhabitants to receive them, though they brought sickness and death into almost every family where they came." He dealt with 363 and buried 59. At Harwich 125 were attended by a surgeon. Robert Seaman, who buried 22.

A petition to the Protector from thirty-four patients at Dover on September 2 said: "We have been carefully attended by Edward Cooke and his assistants and our dangerous wounds dressed, but, as in our fractured bones many ossicles may exfoliate in this cold piercing air, we beg removal to hospitals in London. We understand you have ordered the Dover surgeons to take care of us: but one is a public drunkard, and the other too old for employment."<sup>1</sup>

#### ROYALIST PHYSICIANS AND SURGEONS.

ALDERNE, EDWARD, M.D. Among the Royalist prisoners at the capture of Hereford.

ATKINS, Dr. NATHANIEL. Of Broughton, Lancs. Engaged in the two civil wars. Was physician and surgeon during the defence of Lathom House by Lady Derby, 1644.

BATE, Dr. GEORGE, M.D.Oxford, F.R.C.P. In attendance on Charles I during the siege of Oxford. Later physician to Cromwell and Charles II. Died 1669.

BROONE, ANDREW. Apothecary of Grantham, Lincs. Compounded for his estate, 1651.

BROWN, ROBERT, the Herbalist, M.D.Oxford. Mortally wounded when Lieutenant-Colonel of Rawden's regiment at the defence of Basing House, 1646, where he displayed great gallantry.

BRUGIS, THOMAS. Surgeon of Rickmansworth. Surgeon and physician in the Royalist army which he deserted 1646. Compounded for his estate 1650.

CHANCE. Apothecary to Charles II in the Scottish and Worcester campaigns, 1650-51.

CLARKE, WILLIAM. Surgeon of Bridgnorth. Apprentice to Wiseman. Prisoner at Worcester, 1651.

CLOWES, WILLIAM (1582-1648). Son of the famous surgeon. The King's Serjeant Surgeon during the Siege of Oxford. Compounded under the articles of capitulation there, 1646.

CONSETT, JOHN, M.A. Practising physician of Sand Hutton, Yorks. In arms for five months, 1641, submitted 1645. Assisted as surgeon at the Siege of Pontefract by the Parliament, 1649.

DENTON, WILLIAM. Doctor of Physic. Described as one of the King's servants. Surrendered under the articles of the Oxford Capitulation, 1646. Fine £55. Died 1691.

DOWD. Surgeon of Middlesex. His estate ordered to be seized 1651.

<sup>1</sup> Calendars of State Papers Domestic.

- FRAIZER, Sir ALEXANDER (1610–81), M.D., F.R.C.P. Attended Charles II in Cornwall, on the Continent, and in the Worcester campaign, 1650–51.
- GREAVES, EDWARD, M.D. Surrendered, and compounded (£25), with the garrison of Oxford, 1646. He was M.D.Oxford, F.R.C.P., and later a baronet and physician to Charles II. Died 1680.
- HARVEY, WILLIAM (1578–1657). The discoverer of the circulation of the blood. Served with the King at Edgehill and during the Siege of Oxford.
- MOLINS, EDWARD. Surgeon of London. Surgeon to Barts and St. Thomas's Hospitals. Fought in the Royalist army. Prisoner at capture of Exeter, 1646. Fine £50. Died 1663.
- PAINTER, HUMPHREY. Surgeon. Compounded for his estate, 1649. Serjeant Surgeon to Charles II. Died 1672.
- PYLE, RICHARD. Serjeant Surgeon to Charles I. Served in the last Western campaign and accompanied Charles II to Jersey.
- QUESTION, JOHN. Surgeon of Dunster, Somerset. Captain in King's army, which he deserted. Had property burnt at the Siege of Dunster Castle where he treated wounded Roundheads. Compounded his estate for £135. A surgeon in Cromwell's army, 1646.
- SEELE, JOHN. Surgeon of Cambridge. Joined Royalist garrison at Newark and returned home after its surrender to the Scots, 1646. Estate compounded for £50.
- TURNER, SAMUEL, M.D.Padua. Physician in Ordinary to Charles I. M.P. for Shaftesbury. Compounded on the Articles of Oxford, 1646. Died 1647.
- WEDDERBOURNE, Sir JOHN (1599–1679), M.D.Oxford. Professor of Philosophy, St. Andrew's. King's physician in Scotland. Was with Charles II in Holland. Compounded his estate, 1650.
- WISEMAN, RICHARD (1622–76). Surgeon. Details already given.

#### PHYSICIANS AND SURGEONS OF THE PARLIAMENTARY ARMIES.

- ANTHONY, JOHN. Surgeon to a troop of Bedford's Horse, 1642.
- BARKSDALE, FRANCIS, M.D. Physician to Ely House and the Savoy in 1658.
- BARROW, Dr. SAMUEL. Physician-General to Monk's army in Scotland.
- BISHOP, HENRY. Appointed apothecary at Ely House, 1658.
- BRICKNELL, JAMES. Surgeon to a troop of Bedford's Horse, 1642.
- BROUGHTON, JOHN. Surgeon of Lord Wharton's regiment, 1642.
- BROWNE, JOHN. Surgeon of Colonel Charles Essex's regiment, 1642.
- DAY, WILLIAM. Apothecary at Ely House in 1657.
- DE BOATE, Dr. ARNOLD, M.D.Leyden. Hebrew scholar. Physician-General in Ireland.
- DE BOATE, Dr. GERARD (1604–50), M.D.Leyden.—Brother of above, also a Hebraist. Physician in a hospital in Dublin, 1649.
- CLEARE, JOHN. Surgeon, Lord Brooke's regiment, 1642.
- COOKE, EDWARD. Surgeon, Lord Robarte's regiment, 1642.
- FRENCH, JOHN (1616–57), M.A., M.D.Oxford. Physician H.Q. New Model, c. 1647. Died in the Flanders campaign, 1657.
- GLISSON, Dr. HENRY. Physician-General Lord Manchester's army, 1642.
- HARRIS, NICHOLAS. Surgeon, Sir William Constable's regiment, 1642.
- HEITHLEY, JAMES. Surgeon of Dragoons, 1642.
- LOWE, Dr. LAWRENCE. Surgeon to the Train and Person, Lord Essex's army, c. 1643. He was a surgeon in the Scots' War, 1640.
- LYNNE, MARMADUKE. Apothecary-General, 1649.
- PAGET, NATHAN (1615–79), M.D.Leyden, M.A.Edin. Physician to the Tower, 1650. A friend of Milton.

- PARKES, WILLIAM. Surgeon, Lord Essex's regiment, 1642.  
 PAYNE, Dr. Physician H.Q. New Model, 1645.  
 PIERCE, JAMES. Surgeon to Colonel Ayres' regiment, 1660. To Buffs, 1665. S.G., 1681, and Serjeant Surgeon to Charles II.  
 PORDACE, Dr. JOHN. Physician to Colonel Venner's regiment at Windsor. Later minister at Bradfield, Berks. Ejected 1655. An astrologer. Died 1681.  
 QUESTION, JOHN. Surgeon to Parliamentary Forces, 1646. (*See under Royalists.*)  
 RAND, JAMES. Apothecary Savoy Hospital in 1653.  
 RICE, JOHN. Surgeon to Earl of Stamford's regiment, 1642.  
 ROBERTS, WILLIAM. Surgeon to Lord St. John's regiment, 1642.  
 ST. JOHN, Dr. JOHN. Physician to Commander-in-Chief, Essex's army, c. 1643.  
 SALTONSTALL, Dr. Physician to the Forces at Mardyke, 1657.  
 SEARLE, RICHARD. Surgeon, Colonel Bamfield's regiment, 1642.  
 STRANHIL, Dr. Physician H.Q. New Model, 1645.  
 STANNARD, WILLIAM. Surgeon, Lord Mandeville's regiment, 1642.  
 SWRIGHT, JAMES. Surgeon to a troop of Bedford's Horse, 1642.  
 SYDENHAM, Dr. THOMAS (1624-89). The famous physician. Fought for Parliament, 1642-45. Captain of Cavalry, 1651.  
 TRAPHAM, THOMAS. Surgeon to Skippon's regiment, 1644. S.-G. to Officers of Horse in Ireland, 1649. Surgeon Savoy Hospital, London, 1653. Surgeon-General in Flanders, 1658.  
 TROUTBECK, Dr. JOHN. Chief surgeon to Cromwell's army in Scotland, 1650.  
 WALES, JOHN. Surgeon 4th troop Thomas Rippon's Dragoons, 1650.  
 WARD, HUGH. Surgeon to a troop of Bedford's Horse, 1642.  
 WATERHOUSE, Dr. JOHN. Cromwell's S.-G. in Ireland, 1649. M.D.Oxford, 1651.  
 WEBB. Master Apothecary, H.Q. New Model, 1645.  
 WHISTLER, Dr. DANIEL (1619-84), M.D.Oxford. President R.C.P., 1649. Medical Director for the care of wounded seamen in the Dutch War.  
 WINTER, JAMES. Surgeon-General to Cromwell in Ireland, 1649. He was surgeon to Sir William Fairfax's regiment, 1642.  
 WOODWARD, JOHN. Surgeon to Sir John Merrick's regiment, 1642.  
 WRIGHT, LAWRENCE, M.D.Camb., F.R.C.P. (1622). Physician-in-Ordinary to Cromwell.

The above list has been compiled mainly from Peacock's *Army Lists of the Roundheads and Cavaliers*, *Calendars of State Papers Domestic*, and *Committees for Compounding*.

## Current Literature.

### Treatment of War Wounds by Sulphonamide Packs.

In a letter to the *Lancet* of July 27, 1940, Colonel L. Colebrook describes some work which he was privileged to see done at the Pasteur Institute. This work was recently reported by Dr. Legroux to the Paris Academy of Surgery and published in its *Mémoires*.

In the experiments the adductor muscle of the guinea-pig's thigh was exposed and a portion of it crushed with pliers to simulate an injury from projectiles. The wound was then heavily infected by inserting in it a piece of gauze impregnated with a neat culture of a hæmolytic streptococcus or

of one of the gas gangrene bacilli. After a thorough dusting with sulphonamide powder the wound was sutured. It was found that a single application of sulphonamide powder delayed infection one and a half to two days. If the wounds were reopened then and dusted again with the powder without removing the gauze death was deferred for three to five days. These late deaths were associated with a fall in the concentration of sulphonamide in the blood to less than 1 mg. to 100 c.c. In order to maintain a higher level another series of rabbits, similarly infected and powdered, was given a daily dose of sulphonamide starting from the second or third day; these animals survived though the wounds suppurated. After removal of the gauze on the twelfth day and a further dusting the animals made a complete recovery. The anaerobic bacilli associated with gas gangrene are not so susceptible to sulphonamide, but even these are delayed in action and with two dustings the animals' lives were saved if the gauze was removed at the second dusting but without excision of the injured muscle. If the wounds were not packed and sulphonamide given by the mouth, it had little or no effect on the infection.

Dr. Legroux suggested to the French surgeons that the wounds should be dusted with sulphonamide as early as possible, and a dose of 2 grammes should be given by the mouth at the same time. There should be a second dusting with sulphonamide if débridement is carried out many hours after the first treatment.

Colonel Colebrook says that such bacteriological observations as they were able to make showed that the packs did hold up microbic growth in the wounds for several days. An important question arose: Is it feasible to distribute the powder through a deep wound prior to its surgical treatment? Dr. Legroux recognized the difficulty and recommended for trial in the French Army a very efficient hand-operated air pump of about 500 c.c. capacity mounted on a light tripod. Every stroke of the pump raised a considerable storm in a 10-oz. bottle of sulphonamide powder which is carried thence by a rubber tube to a glass nozzle inserted in the wound. Two of these pumps given by M. Legroux have proved very satisfactory in English hospitals for dusting wounds after débridement. Further experience is necessary to see how it will succeed in wounds prior to débridement. With sulphonamide there should be a better chance of reaching the nooks and crannies than with antiseptics usually employed as it is very diffusible and is also readily absorbed from the wound and acts simultaneously by way of the blood-stream.

For tubular wounds with a small aperture M. Legroux has recommended the insertion of one or more crayons about 2 inches long and containing 2 grammes of the powder. These crayons have the advantage that they are slowly absorbed; such crayons have been found only half absorbed twelve hours after insertion. In these circumstances it might be advantageous to use crayons of the less soluble sulphonamides, i.e. sulphapyridine or sulphathiazole—in order to prolong the bacteriostatic action.

Colonel Colebrooke states that it is becoming more and more evident that infection by hæmolytic streptococci does not usually occur when the man is wounded, but later on during his stay in hospital. Sulphonamide packs will not prevent these late infections, for the drug will have disappeared from the wound. When there is any fear of such infection it will be wise to follow up the pack, starting on the second or third day with the drug given by the mouth according to the instructions given in the War Office Memorandum.

In our hospitals there should be no overcrowding of the surgical wards. Facilities should be provided for the isolation of streptococcus-infected patients. The danger of dust should be eliminated as far as possible by wet sweeping or treatment of floors with some oily preparation such as florigene. Rubber shoes and masks should be worn when dressing wounds. Finally, we should secure the rapid healing of wounds by suture or skin grafting, or, when that is not feasible, uncover them as little as possible.

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## Reviews.

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MEDICAL DISEASES OF WAR. By Sir Arthur Hurst, M.A., D.M.Oxon.  
F.R.C.P. London: Edward Arnold and Co. 1940. Pp. viii + 327.  
Price 16s.

In this latest edition of his well-known work on War Diseases Sir Arthur Hurst is fortunate in having as collaborators Dr. H. W. Barber, who deals with certain skin afflictions incidental to war; Dr. F. A. Knott, who is responsible for the sections dealing with bacteriology and serology; and Dr. T. A. Ross, who has contributed an interesting chapter on the anxiety neuroses of war.

The major part of the book is, as in previous editions, devoted to an account of the varied functional conditions, especially those of a hysterical character, incidental to war and war conditions. My only criticism of this interesting and well-documented section is that the author attaches rather more importance to the organic effect of shell blast on the central nervous system in the causation of some of these functional complaints than many authorities will admit. At the same time he is careful to stress that in the vast majority of cases the term shellshock is little more than a "courtesy title" for a state of mind which has more to do with the *fear* of shells than the effects due to their explosions.

In an interesting chapter dealing with trench fever the author emphasizes the military importance of this peculiar "war affliction," from which upwards of 45,000 men (the strength of an army corps) were away from duty for an average of three months during each year of its prevalence. He remarks that this debilitating disease died out after the armistice and

has not been seen in any country since 1919. This may be so, but there are those who claim that Weigl's disease, a rickettsial illness, of which localized institutional outbreaks have occurred in Poland as recently as 1939, is identical with trench fever. If this is the case there is little reason to doubt that unless "lousing" and louse prophylaxis can be brought to a much greater degree of perfection than was the case in the last war, we shall have trench fever and other louse-borne diseases once more amongst us ere long. Sir Arthur Hurst is guilty of a small "entomological inexactitude" when he speaks of the *bite* of the louse being of importance in the transmission of trench fever. The Rickettsiæ (*R. quintana*) are only found in the excreta of the louse and man is infected as the result of contamination of scratches, abrasions, etc., with the excreta which may remain infective for a far longer period than the sixteen days mentioned (Buxton mentions sixty-six days as the limit in his book, "The Louse").

In discussing the differential diagnosis of trench fever the author makes no mention of dengue, the symptomatology of which, as also the characteristic temperature chart, may closely resemble the first-named disease. In fact, the description given of some types of trench fever, especially those in which a rash and conjunctivitis are prominent symptoms, would pass for an excellent clinical description of dengue. It is realized, of course, that dengue may be ruled out as a possibility in many districts where the mosquito vector (*Aedes ægypti*) of this disease does not exist.

In a chapter on the typhoid group of fevers the author mentions the importance of sputum as a possible source of infection, especially in the case of those suffering from complicating bronchopneumonia. The section dealing with the bacteriological and serological aspects of this group, contributed by Dr. Knott, is concise and up to date. It includes much recent work of importance amongst which may be mentioned the discovery by Felix of the Vi-antigen and the practical applications thereof; also the isolation by Craigie of phages specific for various virulent strains of typhoid bacilli, a brilliant piece of research work which bids fair to be of great epidemiological importance in tracking down and connecting outbreaks of typhoid fever. Dr. Knott is not correct, I think, when he limits the period during which typhoid bacilli may be isolated from the urine to the bacteriæmic phase of the disease. Occasionally, convalescent urinary carriers of typhoid may continue to pass the bacilli in the urine for many weeks after the temperature has returned to normal. He is also rather optimistic when he remarks that 80 per cent of cases give positive cultures during the first five days of the disease, or that by the end of the third week "bacilli are plentiful in the fæces in most cases." In the section dealing with the treatment of this group of diseases Sir Arthur Hurst recommends a considerably more liberal and less wholly fluid diet than is considered advisable or safe by many authorities. He argues that the risk of hæmorrhage and perforation is not thereby increased and that the chewing of hard biscuits, etc., helps to keep the mouth clean and promotes the



flow of saliva; an exclusively milk diet, on the other hand, is apt to increase the tendency to distension with perforation as a not infrequent sequel. Modern practice and experience tend to support the author's views on this matter.

In a chapter dealing with tetanus, an interesting account is given of the effect of prophylactic A.T.S. on the incidence and mortality of this dread complication of war wounds. During October, 1914, before prophylactic serum came into general use, no less than 31·8 per thousand of total wounded suffered from tetanus. This high figure fell sharply to 0·9 per thousand by December, 1914 (at which it remained throughout the rest of the war) following the general introduction of this important prophylactic measure. There was also a very considerable, if less dramatic, fall in the mortality, due largely to the same cause. Thus during the first year of the war the mortality from tetanus averaged 57·7 per cent (compared with 90 per cent in the Franco-Prussian War and 85 per cent in civilian practice prior to the introduction of prophylactic A.T.S.); whereas by 1918 it had shrunk to 19 per cent. A good and graphic description is given of localized tetanus, the greatly increased incidence of which was attributed to the incomplete protection given by prophylactic injections of A.T.S. Mention is also made of the active immunity conferred by Ramon's tetanus toxoid, a measure of protection not available during the last war. Let us hope that, with the additional aid of this valuable measure, tetanus will become of only historical and anecdotal importance. In passing, it should never be forgotten that tetanus may be an occasional complication of severe trench foot, all severe cases of which should receive prophylactic A.T.S. injections. It remains to be seen if this measure will still be necessary in the case of those already actively immunized with Ramon's tetanus toxoid.

A full description is given of the different varieties of jaundice met with under war conditions, including spirochaetal jaundice which the author prefers not to call Weil's disease, a good description having been given of it by Larrey, Napoleon's surgeon, in 1800 during the Egyptian campaign. The author's well-known hypothesis of the dual personality of non-spirochaetal epidemic and sporadic jaundice is convincingly explained.

In discussing war nephritis the author puts the question: Is this a special war disease, *sui generis*, or is it ordinary (peace-time) nephritis modified by war conditions? Whilst most authorities, including the author, argue in favour of the second alternative, a wholly satisfactory answer has not yet been given.

In an interesting account of bacillary dysentery as affected by war-time conditions the author raises some controversial points. In discussing the transmission of bacillary dysentery by flies he states "the infection is probably never carried by the fly on its legs, body, or proboscis." There is at least experimental proof that transmission by such a means may take place, although the chief danger probably arises from bacilli ingested by the fly and subsequently defaecated or regurgitated on to food, etc. Most cases

of so-called malarial dysentery are, he says, due to mixed infections. This is difficult to prove or disprove, but the rapid response of most of these cases to a few doses of quinine suggests that in many cases at least malaria, alone, was responsible for the symptoms.

In referring to the value of saline treatment in bacillary dysentery the author states that this measure was unpopular amongst Anglo-Indian physicians, suggesting as a reason for this "that this difference of opinion is now known to be due to the fact that the treatment is only of value in bacillary dysentery which is *less common* (the italics are mine) than amœbic dysentery in many parts of India." It may be stated here that this myth as to the relative frequency of amœbic dysentery in India was exploded many years ago largely owing to the researches of Manifold and Large, of our Corps. In every station in India where controlled investigations have been carried out by competent bacteriologists, bacillary dysentery has been found to represent a high percentage (about 90 per cent) of all cases of dysentery.

The book is brought to a close with a short account of the clinical aspects of gas poisoning.

Sir Arthur Hurst and his collaborators are to be congratulated on an excellent piece of work, and one hopes that they will be able to find time to keep the book up to date by the production of fresh editions as the war and its diseases unfold.

S. S.

A CATECHISM OF AIR RAID PRECAUTIONS. Fifth (Revised) Edition. By Norman Hammer, Major, R.A.M.C. (Retd.). London: John Bale, Sons and Curnow, Ltd. 1939. In Two Volumes. Part I, pp. 118. Part II, pp. 157. Price 1s. each volume.

Intended for the use of members of A.R.P., first-aid and casualty services, air-raid wardens and the lay public, these two volumes cover the subject of air-raid precautions in an extremely comprehensive manner. Gas, as compared to the other dangers of air attack, has been given prominence and the subject is satisfactorily covered. Important points are discussed in detail and emphasized by repetition. In future editions it might be advisable to include a section dealing with the important subject of inter-communication and the writing and despatch of messages under war conditions. There are a few minor inaccuracies, but these do not in any way detract from the value of the publication, which will be found most valuable for use during discussion and training, and for rapid reference in an emergency. It can be confidently recommended.

J. H. C. W.

GREEN'S MANUAL OF PATHOLOGY. Sixteenth Edition. By H. W. C. Vines, M.A., M.D. London: Baillière, Tindall and Cox. 1940. Pp. viii + 1,166. 701 Illustrations. Price 31s. 6d.

This new edition of an old favourite textbook will be welcomed by a large body of medical students. Although practically the whole of the subject matter has been revised and brought up to date the general arrange-

ment has remained unchanged. The teaching is orthodox and the descriptions of morbid processes are clear and readable in spite of the size of the book. The added attraction, from the students' point of view, is the large number of excellently produced black and white photographs that have been chosen with care to demonstrate the conditions described. Photomicrographs are popular and attractive, but their value, from the point of view of the teacher, is limited by the fact that they can only show one field at a time, whereas it is seldom that a single field of any section can tell the whole story. Nevertheless the majority of these black and white photographs are of a high standard; the coloured ones are less successful and their teaching value is doubtful.

When the first edition of this book was written bacteriology, immunology, and parasitology did not occupy such important places in the teaching of medicine as they do to-day. Until recently this manual devoted considerable space to these subjects. In the volume under review Dr. Vines has omitted much of this subject matter, but it would have been wiser to have been more drastic. These subjects can only be adequately dealt with in special textbooks and a students' manual of pathology can only be concerned with the morbid processes resulting from the infections. It is difficult to ensure that a condensed description is really accurate; such a statement (page 279) as "the presence of cysts (*Entamoeba histolytica*) in the stools is of greater diagnostic value than the presence of amœbæ" is misleading. There is a slip on page 251 where, what is presumably coccidioides, is described under the heading of coccidiosis.

In the realm of tissue pathology, however, the book maintains a high standard, and if we pity the medical student who has to assimilate so much to satisfy his examiners we must blame the present-day curriculum and congratulate Dr. Vines on the presentation of his subject in such an attractive manner.

H. J. B.

LANDMARKS AND SURFACE MARKINGS OF THE HUMAN BODY. Eighth Edition. By L. Bathe Rawling, M.B., Ch.B. Cantab., F.R.C.S. London: H. K. Lewis and Co. 1940. Pp. viii + 98. Price 8s. 6d. net.

The death of Bathe Rawling, announced just after the publication of the eighth edition of his well-known "Landmarks and Surface Markings," reminds us of his contributions to medical science. His passing will be regretted by friends and colleagues. These need nothing tangible to remember him by. To those who knew him not, this book, so deservedly popular, will endure as a monument to his memory.

D. C. M.

TRIANGULAR BANDAGING WITHOUT WORDS. London: John Bale and Staples Limited. Pp. 32. Price 1s.

This brochure representing, by illustrations, all stages in triangular bandaging, should clearly indicate to any inexperienced person how to apply a bandage accurately.

## Correspondence.

### INTENSIVE TREATMENT OF GONORRHOEA WITH M & B 693.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—Having read with interest in the April number of the Corps Journal an article by Buist and Simon on the Intensive Treatment of Gonorrhœa with M & B 693, it occurred to me that Major Buist might be interested to hear my results of the treatment of 115 cases with a similar intensive course.

Like Major Buist, my "massive dose method" was commenced in May, 1939, as a result of reading an article by Bowie, Anderson, Dawson and Mackay in the *British Medical Journal* of April 8, 1939.

The treatment was the same as that used by Major Buist, except that I gave one extra day's treatment—giving six tablets divided into four doses on the fourth day. The patients were kept in hospital until (1) They had been off treatment for at least four days; (2) they had given two negative prostatic smears; (3) they were dry; (4) the urines were clear.

Out of 115 cases treated 105 (91·3 per cent.) were out of hospital within an average of 10·33 days. Only 45 of these cases were given irrigations and only four relapsed. All cases were kept on surveillance for at least two months after leaving hospital.

The ten cases which failed to respond to this massive dose method responded to M & B 693 at a later date and were discharged hospital in an average of forty days.

Very few cases showed toxic effects and these were all trivial in character and disappeared as soon as the drug was stopped.

In my opinion the massive dose method is the one of choice for acute anterior infections, as it not only is the quickest, but seems to give rise to fewer failures and to less toxic results than the longer course with a smaller dosage.

Several instances can be quoted of men playing football for their battalion within forty-eight hours of leaving hospital without any ill-effects as a result.

*Kowloon, Hong Kong.*

*Combined Military Hospital.*

*June 6, 1940.*

I am, etc.,

J. M. OFFICER,

*Major, R.A.M.C.*

### MILITARY HOSPITALS—CHOICE OF SITE AND DESIGN.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—The accommodation for the dental officer as proposed in the site plan for a general hospital, 600 beds (page 106 of your August issue), would, I fear, be inadequate and unsatisfactory.

A north light should be provided for dental operative work, and as numbers of out-patients invariably attend for treatment it would be very

undesirable that they should be in such close proximity to the resuscitation ward.

A suitable lay-out for the dental department of a general hospital, 600 beds, is depicted in War Office D.F.W. drawing No. H.832/38, and such a building would best be located in the space to the north-east of the board room if the proposed plan were adopted. A corridor from the dental department should be connected with that shown for medical and surgical walking cases in order that cases from the medical and surgical wards may reach the dental officer under cover.

*The War Office,  
Hobart House,  
Grosvenor Place, London, S.W.1.  
August 15, 1940.*

I am, etc.,  
D. CLEWER, Colonel,  
Director, Army Dental Service.

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### Notices.<sup>1</sup>

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#### "TABLOID" PHENOBARBITONE AND BROMIDE.

THE simultaneous administration of potassium bromide and phenobarbitone is thought to be a valuable therapeutic measure in the treatment of nervous diarrhoea and other types of gastro-intestinal dysfunction in which sedative and antispasmodic medication is indicated. These medicaments are combined in "Tabloid" Phenobarbitone and Bromide, a recent addition to the range of products issued by Burroughs Wellcome and Co. Other conditions in which it may be prescribed include epilepsy and allied disorders involving hyper-excitability of the motor cortex, delirium tremens, nervous insomnia, and thyrotoxicosis.

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#### KRAMSOL.

BOOTS PURE DRUG COMPANY have sent us the following information about a new preparation Kramsol, a sterilizing agent for surgical and dental instruments. Kramsol (instrument sterilizing fluid) is a solution of very high germicidal potency containing the powerful antiseptic amyl-metacresol, formaldehyde, and other ingredients. It is recommended as a sterilizing agent for surgical and dental instruments. Extensive tests have shown Kramsol to be free from corrosive properties and, providing the plating is intact, most metal instruments may remain immersed in the fluid for weeks without harm. Bacteriological experiments have shown that instruments heavily infected with blood-serum containing numerous sporing and non-sporing bacteria and allowed to dry, will be freed from living non-sporing bacteria in less than fifteen minutes, and from all bacteria in four hours after immersion in Kramsol.

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<sup>1</sup> These notices are for the purpose of acquainting officers with the latest developments in therapeutics, but do not imply that the preparations mentioned have been added to the list of authorized drugs.

# JOURNAL OF THE ROYAL ARMY MEDICAL CORPS

## Corps News.

SEPTEMBER, 1940.

### EXTRACTS FROM THE "LONDON GAZETTE."

*July 16.—Temporary Commissions.*—Capt. R. G. Bannerman, M.D. (80300), relinquishes his commn. on account of ill-health, retaining the rank of Capt. Jan. 3, 1940. (Substituted for the notifs. in the *Gazettes* of Jan. 2 and 23 and Feb. 23, 1940.)

*Short Service Commission.*—Lt. C. J. Murray (94897) resigns his commn. June 11, 1940.

Lt.-Col. C. E. L. Harding, M.B. (15622), R.A.M.C. (ret. pay), at his own request, relinquishes the rank of Lt.-Col., whilst empld. in the temp. rank of Maj. June 20, 1940.

*July 19.*—Col. J. R. Hill (late R.A.M.C.), having attained the age for retirement, retires July 10, 1940, and remains empld.

The undermentioned Lt.-Cols. to be Cols.:—

H. N. Sealy, from R.A.M.C., July 10, 1940, with seniority Feb. 15, 1938.

A. Jackson, from R.A.M.C., July 20, 1940, with seniority Mar. 24, 1938.

Maj. W. K. Campbell, D.S.O., M.B.E., M.C., M.B., to be Lt.-Col. July 10, 1940.

Maj. (temp. Lt.-Col.) C. G. G. Keane, O.B.E., to be Lt.-Col. July 20, 1940.

*Short Service Commissions.*—The appt. of Lt. R. M. Hector, M.B. (85411) is ante-dated to Apr. 1, 1938, under the provs. of Art. 39, Royal Warrant for Pay and Promotion, 1940, but not to carry pay and allces. prior to Feb. 1, 1939.

Lt. R. M. Hector, M.B. (85411) to be Capt. Feb. 1, 1940, with seniority Apr. 1, 1939. (Substituted for the notifi. in the *Gazette* of Feb. 20, 1940.)

The appt. of Lt. F. D. FitzG. Steede (89980) is ante-dated to Dec. 1, 1938, under the provs. of Art. 39, Royal Warrant for Pay and Promotion, 1940, but not to carry pay and allces. prior to May 1, 1939.

Lt. F. D. FitzG. Steede (89980) to be Capt. May 1, 1940, with seniority Dec. 1, 1939. (Substituted for the notifi. in the *Gazette* of May 7, 1940.)

The undermentioned Lts. to be Capts.:—

J. D. Condon (85881). July 5, 1940, with seniority Feb. 1, 1940, and precedence next below Capt. I. B. Pirie, M.B.

A. R. T. Lundie, M.B. (94926). July 7, 1940.

D. S. Milne, M.B. (94929). July 7, 1940.

T. P. Howkins (51295). July 20, 1940.

Lt.-Col. C. E. L. Harding, M.B. (15622), R.A.M.C., at his own request, reverts to the rank of Maj. whilst empld. during the present emergency. June 20, 1940.

Lt.-Col. G. D. Jameson (20698), h.p. list (late R.A.M.C.) retires on ret. pay on account of ill-health. July 10, 1940.

*July 23.*—Col. P. S. Tomlinson, D.S.O., M.R.C.P., late R.A.M.C., to be Dir. Med. Servs. and is granted the actg. rank of Maj.-Gen. Apr. 10, 1940. (Substituted for the notifi. in the *Gazette* of July 12, 1940.)

Capt. (Qr.-Mr.) R. W. Cole, M.B.E., to be Maj. (Qr.-Mr.). July 22, 1940.

*July 26.*—Col. A. L. Stevenson, M.B., late R.A.M.C., retires July 27, 1940, and remains empld.

Lt.-Col. (acting Col.) E. C. Beddows, M.C., from R.A.M.C. to be Col. July 27, 1940, with seniority June 14, 1938.

Maj. (temp. Lt.-Col.) H. A. Rowell, M.C., to be Lt.-Col. July 27, 1940.

*July 30.*—Col. F. F. S. Smith, M.D., Ch.B. Edin., V.H.S., I.M.S., is apptd. Hon. Surgeon to The King, Nov. 8, 1939, vice Maj.-Gen. E. W. C. Bradfield, C.I.E., O.B.E., M.B., M.S.Lond., F.R.C.S. Edin., I.M.S.

Col. E. G. Kennedy, M.B., B.Ch. (R.U.I.), D.O.M.S. Eng., I.M.S., is apptd. Hon. Surgeon to The King, Nov. 24, 1939, vice Col. S. G. S. Haughton, C.I.E., O.B.E., M.D., B.Ch., M.A.O. Dub., I.M.S.

Col. R. H. Candy, C.I.E., M.B., B.S.Lond., M.R.C.S. Eng., I.M.S., is apptd. Hon. Surgeon to The King, Jan. 24, 1940, vice Col. W. E. R. Williams, O.B.E., M.B., Ch.B. Edin., I.M.S.

The undermentioned relinquishes his appt.:—

Col. (actg. Maj.-Gen.) H. H. Blake, O.B.E.

M.B., late R.A.M.C. (Res. of Off.), as Dep. Dir. of Med. Serv. and the actg. rank of Maj.-Gen., June 27, 1940, and remains empld.

Lt.-Col. C. McQueen, M.C., having attained the age for retirement, retires July 29, 1940, and remains empld.

Maj. C. F. Anthonisz to be Lt.-Col. July 29, 1940.

The undermentioned Capts. to be Majs. :—

J. B. George, M.B. July 28, 1940.

(Temp. Maj.) J. T. Robinson, M.D. July 29, 1940.

(Actg. Maj.) M. A. Rea, M.B. July 29, 1940.

August 6.—Lt.-Col. J. L. Wood, O.B.E. (5575), ceases to be re-empld. under Art. 496, Royal Warrant for Pay and Promotion, 1940, and reverts to ret. pay. July 30, 1940.

*Short Service Commissions.*—The undermentioned Lts. to be Capts. Aug. 1, 1940 :—

J. H. Prain, M.B., with seniority Sept. 1, 1939, and precedence next below Capt. H. M. S. Beadnell.

L. A. S. Edmondson, M.B.

P. B. Williams, M.B.

The appts. of Lts. G. G. Black, M.B., and T. C. Hallinan are antedated to Sept. 1, 1938, and Feb. 1, 1939, respectively, under the provs. of Art. 39, Royal Warrant for Pay and Promotion, 1940, but not to carry pay and allces., prior to Aug. 1, 1939.

Lts. G. G. Black, M.B., and T. C. Hallinan to be Capts. Aug. 1, 1940, with seniority Sept. 1, 1939, and Feb. 1, 1940, respectively, and precedence respectively next below Capts. J. H. Prain, M.B., and N. F. Field, M.B.

August 9.—Col. J. J. D. Roche, M.B., late R.A.M.C., retires and remains employed. July 20, 1940.

### Regular Army Reserve of Officers.

July 19.—Maj. J. H. Gurley, O.B.E. (5178), having attained the age limit of liability to recall, ceases to belong to the Res. of Off. July 18, 1940, and reverts to ret. pay.

August 13.—Capt. R. C. Robertson, M.C., M.D., M.R.C.P. Edin., F.R.F.P.S. (51071) ceases to belong to the Res. of Off. on account of ill-health. July 14, 1940.

## TERRITORIAL ARMY.

July 16.—Lt. (actg. Maj.) C. Cockburn, M.B., F.R.C.S. (88172), to be Capt., May 3, 1940, with seniority Nov. 3, 1938. (Substituted for notfn. in *Gazette* (Supplement) dated May 7, 1940.)

Lt. R. T. Easton, M.B. (93426), to be Capt., July 15, 1940, with seniority Jan. 15, 1939, next below Capt. (temp. Maj.) N. H. Martin, B.M., M.R.C.P.

Capt. I. M. D. Grieve, M.D. (69593), relinquishes his commn. on account of ill-health. July 15, 1940.

Lt. (War Subs. Capt.) R. J. F. L. Talbot, F.R.C.S. (90544), relinquishes his commn. on account of ill-health. July 15, 1940.

July 19.—Lt. W. G. Russell, M.B. (94541), to be Capt., July 19, 1940, with seniority Jan. 19, 1939, next below Capt. E. H. Thierry.

Capt. G. H. Thomson, M.B. (51995), relinquishes his commn. on account of ill-health. July 18, 1940.

July 23.—Maj. John Charles Alexander, T.D., M.B. (22683), from R.A. (T.A.), to be Maj., July 3, 1940, with seniority Apr. 26, 1934.

Lt. J. G. Lord, M.B. (94763), to be Capt., July 24, 1940, with seniority Jan. 24, 1939, next below Capt. (temp. Maj.) J. D. W. McCrackern, M.B.

Capt. A. C. Frazer, M.B. (56228), from supern. for serv. with O.T.C., to be Capt. Sept. 18, 1939. (Substituted for notfn. in *Gazette* (Supplement), dated Oct. 10, 1939.

Lt. (War Subs. Capt.) C. H. R. Carmichael, M.B. (87735), relinquishes his commn. on account of ill-health. July 22, 1940.

Lt. (War Subs. Capt.) W. A. Kerr, M.B. (88736), relinquishes his commn. on account of ill-health. July 22, 1940.

July 30.—Capt. B. M. Nicol, M.B., from R. Sigs. (T.A.) to be Capt., May 18, 1940, with seniority July 30, 1936.

August 2.—Maj. C. E. Kindersley, M.B., F.R.C.S. (86384), relinquishes his commn. on account of ill-health, and is granted the rank of Capt. Aug. 1, 1940.

Maj. P. W. McKeag, M.D., M.R.C.P. (86386), relinquishes his commn. on account of ill-health, and is granted the rank of Capt. Aug. 1, 1940.

August 6.—Lt.-Col. D. C. MacLachlan, M.B. (25985), having attained the age limit, relinquishes his commn. and retains his rank with permission to wear the prescribed uniform. Aug. 7, 1940.

August 9.—Capt. R. A. Quinn, M.B. (7593) relinquishes his commn. on account of ill-health and is granted the rank of Capt. Aug. 8, 1940.

## THE ARMY DENTAL CORPS.

*July 19.*—*Short Service Commissions.*—The appt. of Lt. R. D. Ogston (78388) is ante-dated to Apr. 3, 1938, under the provs. of Art. 40, Royal Warrant for Pay and Promotion, 1940, but not to carry pay and allces. prior to Oct. 3, 1938.

Lt. R. D. Ogston (78388) to be Capt., Oct. 3, 1939, with seniority Apr. 3, 1939. (Substituted for the notifi. in the *Gazette* of Oct. 24, 1939.)

Lt. (on prob.) F. C. Dutton (95363) is confirmed in his rank.

Lt. F. C. Dutton (95363) to be Capt. July 17, 1940.

*July 30.*—Lt.-Col. T. K. Place (15742) retires on ret. pay. July 31, 1940.

*Short Service Commission.*—Lt. (on prob.) J. H. Robertson (96496) is confirmed in his rank.

Lt. J. H. Robertson (96496) to be Capt. July 31, 1940.

---

## QUEEN ALEXANDRA'S IMPERIAL MILITARY NURSING SERVICE.

*July 16.*—Sister Miss R. M. Wilson retires with a gratuity on account of ill-health. July 17, 1940.

The undermentioned Sisters resign their appts. :—

Miss G. W. Bishop. May 26, 1940.

Miss D. Lewis. June 26, 1940.

Miss J. W. Griffith. July 2, 1940.

Miss M. M. I. Law. July 17, 1940.

*July 19.*—Sister (temp. Matron) Miss E. E. Watkin to be Matron. July 6, 1940.

Sister Miss B. J. Taylor resigns her appt. June 30, 1940.

*July 23.*—Matron-in-Chief Miss C. M. Roy, C.B.E., R.R.C., M.M., retires on ret. pay. July 23, 1940.

Principal Matron Miss K. H. Jones to be Matron-in-Chief. July 23, 1940.

*July 30.*—Matron Miss M. Nicholson, R.R.C., having attained the age for retirement, is placed on ret. pay. July 13, 1940.

Sister (temp. Matron) Miss M. Russell, A.R.R.C., to be Matron. July 13, 1940.

The undermentioned Sisters resign their appts. :—

Miss M. L. R. Jack. July 1, 1940.

Miss K. M. Keane. July 6, 1940.

Miss E. A. Madden. July 31, 1940.

Staff Nurse Miss L. M. Parish resigns her appt. July 31, 1940.

*Aug. 6.*—Staff Nurse Miss E. M. Harding to be Sister. July 1, 1940.

The undermentioned Staff Nurses are confirmed in their appts. :—

Miss M. J. Verity.

Miss M. Downing.

Miss M. Moreton.

Miss F. J. Parry.

Miss D. St. J. Blackman.

Miss L. M. Dobbin.

*Aug. 13.*—The undermentioned appts. are made :—

Matron Mrs. L. J. Wilkinson, A.R.R.C., to be Principal Matron, War Office. July 20, 1940.

Sister (temp. Matron) Miss E. Wright to be Matron. July 20, 1940.

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## TERRITORIAL ARMY NURSING SERVICE.

*July 16.*—Miss I. F. Lang, A.R.R.C., to be Principal Matron. Apr. 8, 1940.

Miss M. G. Milne, Principal Matron, resigns. Feb. 22, 1940.

Miss E. M. Robertson, Principal Matron, resigns. Apr. 8, 1940.

The undermentioned Matrons resign :—

Jan. 1, 1940 :—

Miss J. Atkinson.

Miss V. M. Vandam.

Jan. 24, 1940 :—

Miss K. A. Smith.

Feb. 20, 1940 :—

Miss W. A. K. Bates.

Mar. 4, 1940 :—

Miss B. J. Willoughby.

Mar. 8, 1940 :—

Miss I. Miller.

Mar. 11, 1940 :—

Miss E. Hesketh.

Miss M. M. Hollidge.

Mar. 18, 1940 :—

Miss M. Pirie.

Mar. 28, 1940 :—

Miss E. Wrathall.

Apr. 6, 1940 :—

Miss F. M. L. Sage.

May 10, 1940 :—

Miss M. A. Batey.

Miss A. Gerrard.



## B.E.F. AWARD.

### MILITARY CROSS.

Macdonald, Lieutenant William Thom,  
R.A.M.C.

On June 1, after having spent the night at La Panne tending numerous casualties under continuous shell fire, Lieut. Macdonald received instructions to embark wounded on to a beached paddle steamer at Bray les Dunes. Realizing that the stranded steamer

presented an easy target from the air he decided to place the wounded on a lifeboat and row them out to sea. The lifeboat was overfull, and in getting it away he injured his left arm. They were not far away when a direct hit was seen to take place on the paddle ship, and she burst into flames. Three successive bombing and machine-gun attacks were made on the small boat, but without success.

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## THE NORWEGIAN CAMPAIGN.

THE War Office announces the following second list of Norwegian campaign awards:—

In pursuance of powers delegated by the King, the Commander-in-Chief, North-Western Expeditionary Force, conferred the following immediate awards in recognition of distinguished services in the field:—

### MILITARY CROSS.

Evans, Captain (now Major) William Morgan,  
R.A.M.C., T.A.

Major Evans was in command of a company of a field ambulance which was detailed to open an advanced dressing station on the Ankenes Peninsula. This served British, French, and Polish troops, all of whom speak highly of the meritorious work done by him

in the organization and evacuation of the wounded. He carried on under frequent aerial bombardments, during one of which he successfully evacuated a wrecked French dressing station.

Kohane, Captain Michael Joseph, R.A.M.C.

For bravery and devotion to duty in action on April 23. He was attached to a brigade headquarters and had established a central aid post at Tretton. In spite of continuous shelling of this small village he returned many times to evacuate the wounded, and was not content until he had also removed all dressings and medical stores to safety. By this prompt action many wounded were saved from burning.

---

## KILLED IN ACTION.

CAPTAIN JAMES MORRISSEY, R.A.M.C., T.A., was killed in action in France on June 11, 1940. Educated at the University of Liverpool, he graduated M.B. there in 1925. He took the D.C.O.G. in 1935. He practised in Bradford, where he was honorary surgeon to the Bradford Special Constabulary. Commissioned Lieutenant R.A.M.C., T.A., on April 11, 1931, he was promoted Captain on May 1, 1934.

LIEUTENANT THOMAS JAMES STEVEN was killed in action in France on May 31, 1940. Born June 18, 1899, he graduated M.D. Glasgow, in 1931, and was appointed to an Emergency Commission as Lieutenant R.A.M.C., on September 6, 1939.

LIEUTENANT CLAUDE BOWEN JONES, R.A.M.C., attached 8th Worcester Regt., T.A. He was gazetted to an Emergency Commission as Lieutenant R.A.M.C., on January 26, 1940, having graduated M.B. Bristol, in 1938. He lived at Chipping Sodbury, near Bristol.

---

## DIED OF WOUNDS RECEIVED IN ACTION.

CAPTAIN (TEMPORARY MAJOR) LAURENCE O'SHAUGHNESSY died on May 27, 1940, of wounds received in action—a brilliant thoracic surgeon of international repute, built up on the dramatic nature of his work on the heart. Born Dec. 24, 1900, he graduated M.D. Durham, 1930, having taken the F.R.C.S. in 1926. He was a Lieutenant R.A.M.C., T.A., from June, 1923, to Jan., 1924, when he was appointed Lieutenant on Probation R.A.M.C.,

but resigned on June 3, 1924. He served in the Sudan Medical Service from 1924 till 1931, most of which time he was in charge of the hospital at Omdurman. On Oct. 12, 1932, he was reappointed Lieutenant R.A.M.C., T.A., being promoted Captain May 1, 1934, and transferred to the T.A.R. of O. on Dec. 7, 1938. He was recalled to the active list on mobilization on Sept. 1, 1939.

## PRISONER OF WAR.

MAJOR-GENERAL G. A. D. HARVEY, in 1937 appointed Honorary Physician to the

King, is a prisoner of war. He had been missing since May 23.

## GIFT FOR THE PURCHASE OF MEDICAL EQUIPMENT.

THE Director-General has received from a small Company in one of our stations overseas a cheque for £75 with a request that it may be used for the purchase of some item or items of medical equipment, to assist in the prose-

cution of the war. The cheque is large for so small a detachment, and indicates the spirit inherent in the Corps. The cheque is gratefully accepted; it will be devoted to the purpose indicated.

## ROYAL ARMY MEDICAL CORPS AND ARMY DENTAL CORPS COMFORTS GUILD.

A GUILD is being organized to provide comforts for the men of the R.A.M.C. and A.D. Corps. It is hoped that ladies will help by working independently, or by joining local working parties.

Arrangements are being made to issue wool as it becomes available, and any subscription,

however small, towards the cost of providing material will be gladly received. Cheques and postal orders should be made payable to the "R.A.M.C. and A.D. Corps Comforts Guild," and sent to Lady MacArthur, 48, Priory Road, London, W.4; or to Mrs. Clewer, 27, Park Hill, Ealing, London, W.5.

## BIRTH.

O'CONNELL.—On June 24, at Cork, Ireland, to Mary, wife of Major J. J. O'Connell, R.A.M.C., a daughter (Mary Deirdre).

## DEATHS.

ANDERSON.—In Bath, on July 26, 1940, Lieutenant-Colonel Alexander Anderson. A cousin of General Sir James Outram, "the Bayard of India," he was born on Oct. 1, 1843, in Canada, and educated at McGill University, taking his medical qualifications in Edinburgh in 1867. He joined the Army as Assistant Surgeon Staff October 1, 1867, and was appointed Assistant Surgeon 105th Foot the following year. Promoted Surgeon Major October 1, 1879, he became Surgeon Lieutenant-Colonel October 1, 1887, Brigade Surgeon Lieutenant-Colonel April 14, 1894, and retired as Lieutenant-Colonel R.A.M.C. October 1, 1898. He took part in a punitive expedition to Le Hej, Arabia, from Aden in 1873. In the Afghan War of 1878-80 he accompanied D Battery, R.H.A., from Karachi to Kandahar, being awarded the Medal. He also served in the Miranzai Expedition in 1891 and received the Medal with Clasp.

BRUNSKILL.—On July 21, 1940, Lieutenant-Colonel John Handfield Brunskill, D.S.O., O.B.E. Born April 17, 1875, he was educated at Trinity College, Dublin, where he graduated M.B. in 1900 and took the

D.P.H. in 1903. Entering the R.A.M.C. on Nov. 29, 1900, he was promoted Lieutenant-Colonel on August 28, 1918, and retired on April 27, 1920. In the war of 1914-18 he served in France and Belgium and Mesopotamia. He was recommended for the Albert Medal in 1916. Serving in Mesopotamia he was S.M.O. Dunsterforce, North Persia, and A.D.M.S. of the same in 1918. Mentioned in Despatches four times he was awarded the D.S.O., O.B.E., 1914 Star and Clasp, British War and Victory Medals. He was in practice in Kingston-on-Thames, being honorary Medical Officer, Kingston-on-Thames Victoria Hospital, and ex-Chairman of the local division of the British Medical Association.

POTTS.—On May 23, 1940, in Manchester, Lieutenant Thomas Henry Ingram Potts. Educated at Sheffield and St. Mary's Hospital, he took the M.R.C.S. and L.R.C.P. in 1923 and was gazetted to an Emergency Commission in the R.A.M.C. as Lieutenant on January 8, 1940. He was in practice at Chadwell Heath and had served as a Medical Officer in the West African Medical Service.

## EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

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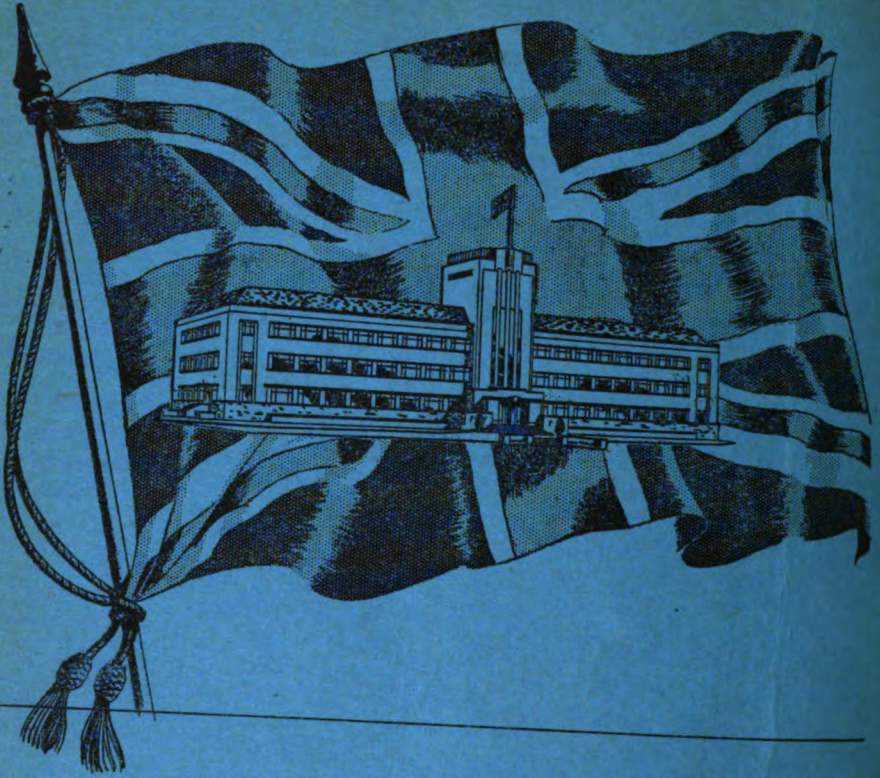
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## CONTENTS

ORIGINAL COMMUNICATIONS.	PAGE	CLINICAL AND OTHER NOTES.	PAGE
The Technique of Virus Culture on Chorio-Allantoic Membrane in Military Laboratories. By Major W. M. E. ANDERSON, <i>R.A.M.C.</i> . . . . .	211	A Case of Dislocation of the Neck. By Major G. T. GIMLETTE, <i>R.A.M.C.</i> . . . .	261
Some Observations Upon the Work of a Mobile Surgical Team. By Major J. M. P. CLARK, <i>M.B., Ch.B., F.R.C.S., R.A.M.C.</i> . . . . .	223	A Case of Meningococcal Conjunctivitis. By Major J. A. BENNETT, <i>R.A.M.C. (R.P.)</i> . . . . .	264
The Organization and Running of an Ambulance Train. By Major C. C. H. CHAVASSÉ, <i>R.A.M.C.</i> . . . . .	227	A Suggested Method of Obtaining Personal Protection in the Field. By Major H. TEMKIN, <i>R.A.M.C.</i> . . . .	265
The Uncertified Chronic Patient. By Captain G. R. A. de M. RUDOLF, <i>R.A.M.C.</i> . . . . .	236	A Case of Double Intussusception of the Small Gut. By Lieutenant-Colonel J. C. ANDERSON, <i>R.A.M.C.</i> . . . .	266
The Treatment of Wound Shock . . . . .	243	Description of the "Sling Seat." By Lieutenant-Colonel (Quartermaster) D. M. MURPHY, <i>V.D.</i> (late of the Royal Canadian Army Medical Corps) . . . . .	268
Handicraft for Soldiers. Relieving Period of Convalescence . . . . .	253	Notes on a Case of Tetanus. By Major P. F. PALMER, <i>R.A.M.C.</i> . . . .	271
EDITORIAL.		CURRENT LITERATURE . . . . .	273
Studies in Nutrition . . . . .	255	REVIEWS . . . . .	275
		CORRESPONDENCE . . . . .	277
		NOTICES . . . . .	280

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THE TECHNIQUE OF VIRUS CULTURE ON CHORIO-ALLANTOIC  
MEMBRANE IN MILITARY LABORATORIES.

BY MAJOR W. M. E. ANDERSON,  
*Royal Army Medical Corps.*

NEARLY thirty years ago Rous and Murphy (1911) employed the chorio-allantois of the developing chick in their study of fowl tumours, and subsequent workers adopted the method to the investigation of other types of neoplasms. Woodruff and Goodpasture (1931) were able to demonstrate that viruses could be cultured satisfactorily on egg membrane. Their early work was concerned with the virus of fowl-pox, but a later paper by Goodpasture, Woodruff and Buddingh (1932) reported the successful culture of the virus of vaccinia and directed attention to the potentialities of the method in producing anti-smallpox vaccine. These findings were confirmed by other workers and, *inter alia*, Sanjiva Rao, Pandit and Shortt (1936) were able to culture the vaccinia virus at the King Institute, Guindy. Of particular interest to the military medical authorities was the extension of the method to the viruses of dengue and sandfly fever by Shortt, Sanjiva Rao and Swaminath (1936).

For the last two years the method has been practised successfully at the District Laboratory, Peshawar, by the Peshawar Section of the Sandfly Fever Inquiry, during which period sera from a very large number of cases of suspected sandfly fever in the wards of the British Military Hospital have been investigated for the presence of virus. Its simplicity, together with the fact that the special apparatus need not be expensive, makes it capable of adoption in military laboratories at home and abroad, either as a means



## 212 *Technique of Virus Culture on Chorio-Allantoic Membrane*

of diagnosis of conditions which are due to a specific virus, or in the investigation of cases where routine laboratory examinations are inconclusive. The indeterminate fevers so commonly met with in the tropics, offer wide scope for work on these lines, and there is every reason to suppose that co-operation between clinician and pathologist will assist in solving problems in diagnosis and may lead to the isolation of some hitherto undescribed viruses. In Europe there are numerous factors, immunological and otherwise, connected with diseases such as influenza, in which there is adequate room for further work. Compared with methods of virus propagation by animal inoculation it is certainly more economical and probably more accurate, as potential fallacies from accidental cross infection, or unexpected natural immunity, are reduced to a minimum.

The method, as used at the District Laboratory, Peshawar, was practically identical with that in use at the King Institute, Guindy, a brief account of which has already been published by Sanjiva Rao *et alia* (1936). Various modifications are practised by other workers, notably Burnet (1936), who claims that his method is suitable as a means of virus titration.

### SUMMARY OF THE METHOD.

Briefly, the technique employed consisted of the inoculation of a small quantity of suspected material (serum, etc.) on to the chorio-allantoic membrane of a hen's fertile egg at approximately the fourteenth day of incubation; three to four days later the membrane is extracted and examined against a dark background for the presence of small whitish yellow opacities known as "lesions." These lesions, if not required for histological examination, are stored in glycerine water and subsequently ground and used for further inoculation. This process of inoculation in series is referred to as "passaging."

It must be noted that, although the lesions can be demonstrated to contain virus particles, it is not correct to refer to them as consisting of virus. They represent the reaction of the membrane to the presence of virus.

### DETAILS OF THE TECHNIQUE.

The first essential is a regular supply of fresh fertile eggs, and in most cases it will be simplest to purchase locally. Should it, however, be possible to keep a small poultry farm attached to the laboratory, the optimum proportion of cocks to hens is 4 : 1, and the fowls should be of an exceptionally good laying strain, such as White Leghorns. If the eggs are bought from dealers, some special arrangement will be required to ensure that as many as possible are fertile and, in Peshawar, the practice was to pay for fertile eggs at slightly more than the current market rate, as notified by the Officer-in-Charge Supplies, and at slightly less for unfertile eggs. About 60 per cent of eggs thus obtained were fertile, which meant that a large number had to be discarded, but this was offset by their very low price.

Eggs are incubated at a temperature of 102° F., or 39° C., slightly higher than that used for bacteriological work. In Peshawar the incubator used was a Hearson "Champion" pattern, which had a drawer capable of containing about ten dozen eggs without undue crowding and, provided that it was housed well away from draughts, could be depended on to maintain a satisfactory temperature. An ordinary Hearson bacteriological incubator was also adapted for egg incubation by fitting the interior with flat wooden egg boxes. This incubator was of the "B1" size (the usual type in military laboratories), which has internal measurements of 12 by 12 by 14 inches, and will take five boxes measuring internally 10 by 10 by 1.75 inches, each holding two dozen eggs. The eggs rest in oval holes, measuring 1.3 by 0.9 inches, cut in the base of the boxes. To ensure adequate ventilation two holes, each

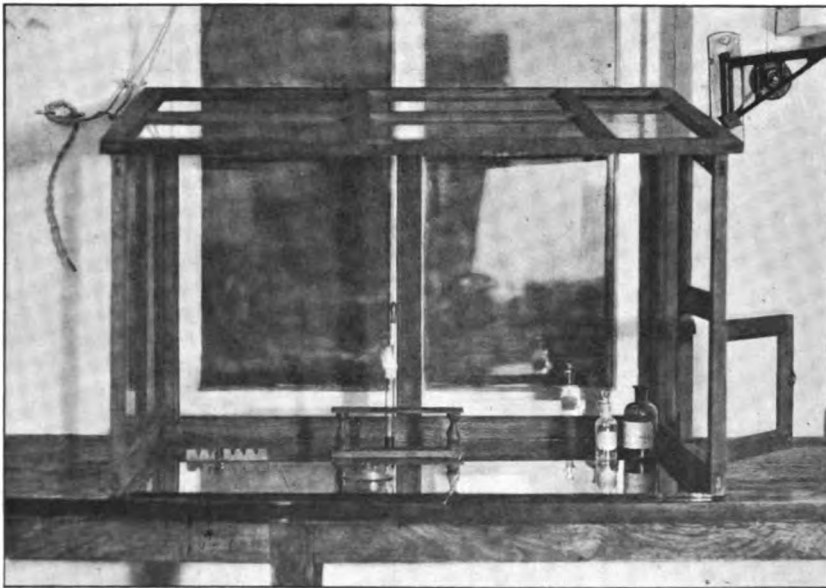


FIG. 1.—Glass chamber for egg inoculation work.

1 inch in diameter, should be cut in the side of each box. A box of the type described, but without these side holes, is shown on the extreme left of fig. 2. These boxes are placed one above the other, on shelves in the incubator, and not more than two to a shelf. A proper egg incubator is fitted with a device for increasing humidity, usually consisting of a shallow zinc tray containing a piece of well-moistened coarse mesh canvas. In the adapted bacteriological incubator, this extra humidity was produced by placing in the lower inside corners a couple of "Felix" tubes, retained in position with plasticine and kept filled with water by means of a capillary pipette, fitted with a rubber teat.

## 214 *Technique of Virus Culture on Chorio-Allantoic Membrane*

Whatever the type of incubator, before being used for eggs, the capsule should be checked as being marked 102° F. (or 39° C.) and as being in a serviceable condition. It should be observed for several days to ensure that an adequate temperature is being maintained, thermometer readings being taken three to four times daily, and it was found a good plan to record also the temperature of the water in the jacket. Too much attention cannot be given to the proper working of the incubator, as a comparatively small drop in temperature is sufficient to kill off developing embryos and to obliterate the work of several days. The practice in Peshawar was to have temperatures read and recorded at least twice a day, at fixed times, so that any slight fall could be noted and investigated.

With the apparatus working properly, the incubation of eggs is commenced. The number of eggs to be taken in daily depends on the space

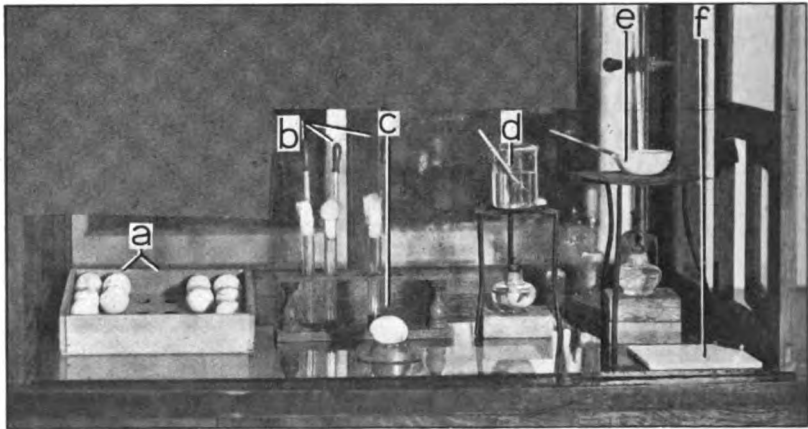


FIG. 2.—Layout for egg inoculation. (N.B.—The beaker and paraffin bath are normally placed on the bench outside the glass chamber.) a, eggs, already inoculated, and awaiting inoculation; b, test tubes containing inoculum; c, egg in egg holder; d, cataract knife in beaker of boiling water; e, paraffin bath; f, glazed tile and grease pencil for recording results.

available and the proportion of “fertiles”, and in Peshawar, with accommodation for up to 230 eggs, the greatest daily intake was one and a half dozen. Before placing in the incubator, each egg was marked in pencil with the date of receipt and the initials of the supplier. The drawers, or egg boxes, were removed from the incubator daily for a short time (ten minutes in tropical heat, five minutes under winter conditions), during which time the eggs were very gently turned.

### TESTS FOR FERTILITY.

It is beyond the scope of this paper to give a detailed account of the development of the embryo and membranes. A good summary is given by Burnet (1936), and a more detailed description by Patten (1935). Although the eggs are not ready for inoculation until, at earliest, the twelfth

day, it is possible as early as the sixth or seventh day to determine, by "candling," whether or not an embryo is present. Candling consists of examining the eggs through a viewing tube in a dark chamber against a bright light. A dark chamber of dimensions 2 by 2 feet by 1 foot 9 inches, was improvised from an upturned tea chest from which one side had been removed and hung with a pair of curtains of black photographers' cloth. The viewing tube consisted of a tube of cardboard or metal, 8 inches long and  $1\frac{1}{4}$  inches in diameter, one end being shaped so as to fit the side of the egg. The light may consist of any sort of lamp arranged so that the beam emerges through an oval opening, 1.6 by 1.3 inches. Satisfactory results were obtained with a strong electric torch fitted with a cardboard mask containing an aperture of the size indicated. With the left hand the egg is held in the opening and the appearance of the contents, as seen through the viewing tube, noted. During this examination the egg should be rotated gently. An unfertile egg appears perfectly clear, or may show vague irregular shadows which move freely as the egg is rotated. If the egg is fertile, a sixth- or seventh-day embryo, in its most typical form, shows as a well-defined semi-opaque disc, towards the centre of which is a small denser area (the embryonic eye), and from which well-defined blood-vessels radiate, the whole appearance being reminiscent of the optic disc as seen through an ophthalmoscope. In many eggs, however, the picture is much less definite, and it is sometimes difficult at this stage to decide whether an egg is fertile or not. It should be remembered that an egg which contains a live embryo will have discernible vessels and well-marked shadows which do not move when the egg is rotated. An egg which appears a dense black is almost certain to be added.

The incubation of such eggs as were not obviously non-fertile was continued until ready for inoculation. For most viruses of medical importance the embryo, or rather its chorio-allantoic membrane, will have reached a suitable degree of development by the thirteenth to fourteenth day, with the twelfth and fifteenth days as outside limits.

Before inoculation eggs were once more candled. At this stage an egg containing a healthy chick shows plentiful blood-vessels, and the outline of the embryo has well-defined edges which may, on careful observation, show slight spontaneous movements, although the embryo as a whole retains its position when the egg is rotated. The following points were taken to indicate embryonic death: (1) Complete absence of visible blood-vessels, (2) undue mobility of the embryo on rotating the egg, (3) absence of spontaneous movements.

With a grease pencil a small mark was made on the shell immediately over the place where the embryonic shadow was densest, this being the most suitable place for inoculation as it is furthest away from the area where the chorio-allantoic membrane is deficient on the inner surface of the shell membrane. At the same time the outline of the edges of the air-space was also marked. This is usually, but not invariably, at the blunt end.

## INOCULATION.

Close to the spot selected for inoculation a small opening in the shape of an isosceles triangle, with  $\frac{3}{4}$ -inch sides and  $\frac{1}{2}$ -inch base, was cut. The best means of doing this was found to be with a dental drill fitted with a carborundum disc 1 inch in diameter. As recommended by Sanjiva Rao *et alia* (1936), when cutting the drill was operated at its slowest speed in order to cause as little injury as possible to the underlying shell membrane; if the cutting is done with care, it is possible to feel when the shell membrane is reached and a definite change in note can be perceived at the same time. Burnet recommends cutting at fast speed with light intermittent touch, but it was found that this was more liable to damage the shell membrane.

The complete thickness of the shell was cut through along the sides of the triangle, the base was only cut half-way through. By means of a camel-hair brush the cut area was covered with a layer of melted paraffin wax and the egg returned to the incubator until ready for inoculation.

As an extra precaution against contamination, some workers have recommended that the selected spot on the shell should be cleaned before cutting by swabbing with 5 per cent carbolic, followed by absolute alcohol. At Peshawar this was discontinued after some months without any apparent ill-effects.

It is possible to remove a fragment of shell at the site of inoculation by means of an entomological needle, but this is more difficult and much less satisfactory than the use of the cutting drill.

The actual inoculation and subsequent manipulations were carried out inside a glass chamber such as that illustrated (fig. 1). The base of this chamber measured 3 feet 4 inches by 2 feet 5 inches, and its roof sloped forwards, the height of the front being 1 foot 10 inches and at the back 2 feet 4 inches. Its floor consisted of a sheet of plate glass, under which were placed sheets of black and white paper. As an extra precaution a curtain of muslin may be hung across the front but, under tropical conditions, this soon became unbearably hot. The roof contained a small square of wire gauze, let into the top right-hand corner, under which a bunsen or spirit lamp could be placed without danger of cracking the glass. A small hinged door, about 1 foot square, was let into the right side to facilitate reaching for instruments, which are boiled up in a beaker of water on the bench outside. The interior of this glass chamber was sprayed daily with a weak antiseptic (3 per cent carbolic).

The material for inoculation (serum, passage virus, etc.) was put up in test tubes plugged with cotton-wool, each containing a glass capillary pipette fitted with a rubber teat; these were placed in a rack inside the chamber. During inoculation (fig. 2) the egg rested horizontally, cut area uppermost, on an egg-holder consisting of a suitably moulded piece of plasticine in a Petri dish. With a sterile cataract knife, held obliquely, the flap of shell was gently levered up, the base of the triangle serving as a hinge. In a healthy egg the shell membrane thus brought into view should be shining

white ; if it appears of a dull and greyish colour, the embryo is probably dead. During the raising of the window the shell membrane is usually torn but, if still intact, it should be incised very carefully with the point of the knife and a small fragment turned back. The chorio-allantoic membrane, which lies immediately under the shell membrane, is glistening and transparent and plentifully supplied with vessels. If the embryo is dead it has a green or grey colour, and its appearance may be described as "lifeless." 0.2 to 0.3 c.c. (3 to 5 drops) of inoculating material were then dropped on the chorio-allantoic membrane from the capillary pipette. If it tended to lie on the shell membrane and not run in readily, the membrane was lifted up carefully with the point of the knife and the fluid was found to run in by suction ; occasionally it was necessary to enlarge the opening slightly. The flap of shell was then replaced and covered with melted paraffin and, with a grease pencil, the egg was marked with the date and number of the inoculum and returned to the incubator. Before inoculating the next egg the cataract knife was placed in boiling water for a few minutes. For convenience, it was customary to inoculate a number of eggs at a time and, while eggs may be kept at room temperature for up to thirty minutes or more, care was taken that they should not be unduly exposed to cold draughts during this time.

Eggs which have been discarded as unfertile, or otherwise unsuitable for inoculation, may be utilised for practising the technique of cutting and inoculating, using plain water. Preliminary experience of this kind is of great assistance in reducing the amount of trauma on the embryo.

#### THE OPENING OF EGGS AND THE COLLECTION OF LESIONS.

In the case of certain viruses (e.g. that of vaccinia) which are toxic to the embryo, or which tend to produce necrosis of the chorio-allantoic membrane, it is necessary to open the eggs on the third day, but in most cases opening is performed on the fourth day after inoculation.

This procedure was also carried out inside the glass chamber (fig. 3). The instruments are first boiled up in a beaker and laid out on sterile dishes within the chamber. Porcelain staining dishes were used for this purpose and were sterilized either by boiling or flaming. If the instruments are laid out as shown, with their points away from the operator, and each is returned to the boiling water immediately after use, there is no necessity to re-sterilize the dishes after each egg is opened. The egg was placed in the holder, the marked air space being uppermost, and cleaned with 3 per cent carbolic, followed by absolute alcohol, and flamed. With an egg breaker (the handle of a 6-inch dissecting forceps) the shell was cracked and chipped away. A circle of shell membrane was cut away with curved fine pointed scissors and the embryo extracted into a Petri dish. As a rule it will fall out freely, but a little assistance with the points of the scissors may be required ; it is necessary to cut across the attachment of the embryo to the membrane and also any other adhesions that may be present, or the mem-

## 218 *Technique of Virus Culture on Chorio-Allantoic Membrane*

brane will follow the embryo into the dish. If the manœuvre is carried out properly the membrane will now be seen lining the inner surface of the shell and the triangular cuts can be clearly seen. With straight fine-pointed

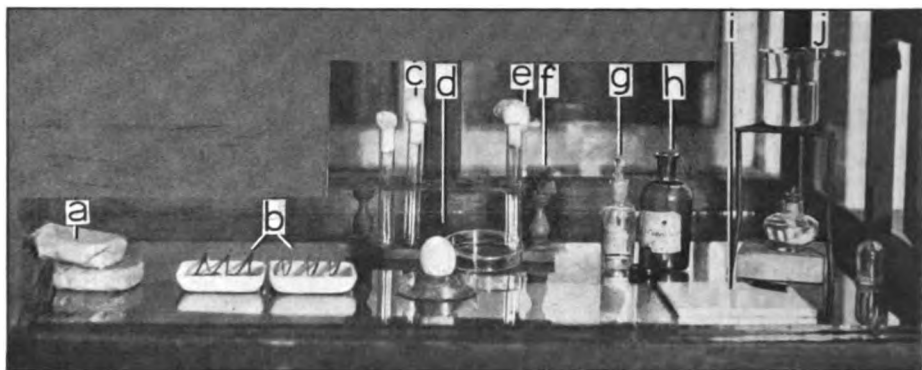


FIG. 3.—Layout for the opening of eggs. (N.B.—The beaker and spirit lamp are normally placed on the bench outside the glass chamber). a, spare Petri dishes (sterile); b, instruments laid out in sterile porcelain dishes; c, test tubes containing collected lesions; d, egg in egg holder; e, 50 per cent glycerine water; f, forceps for use as egg breaker; g, absolute alcohol; h, 3 per cent carbolic acid; i, tile and grease pencil; j, beaker for boiling up instruments.

scissors two cuts were made (fig. 4) through the membrane about  $\frac{3}{4}$  inch clear of either side of the site of inoculation and carried nearly to the pointed end. The proximal end of the portion of chorio-allantoic membrane between

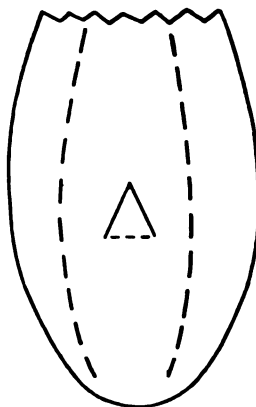


FIG. 4.—Position of scissors cuts made in chorio-allantoic membrane after extraction of embryo.

these cuts was grasped with a pair of fine pointed forceps and the chorio-allantois drawn out gently and deposited in a clean Petri dish. The portion between the cuts, which contained the lesions, if any, was examined in 50 per cent glycerine water, using the convex surfaces of two curved fine-

pointed forceps, with which the membrane can be examined without risk of injury. Against a dark background lesions are readily perceived. Their appearance varies considerably with different viruses, but they can be described as distinctly thickened greyish-white or yellowish-white opacities. In some cases they appear as a single large opacity, with firm edges, measuring up to 10 mm. in diameter and 1 to 2 mm. in thickness, and in others as a large number of small scattered foci, 1 to 3 mm. in diameter. The extent of lesion production is usually recorded by the symbols L++++, L+++, L++, L+, L±, the last of which is used to designate a lesion which, either through its small size or atypical appearance, is "doubtful." The symbol "L" indicates an absence of lesions. If required for further inoculations the lesions were cut out, together with about  $\frac{1}{8}$  inch of membrane about each, placed in sterile test tubes and covered with 50 per cent glycerine water, in which they were stored, in the ice chest, until ready for grinding. At the site of inoculation may usually be seen two thin white lines, corresponding with the cuts which were made in the shell, along which there is a very slight thickening. These are referred to as "marginal lesions," and are not due to the presence of virus. They represent the membrane's response to trauma and serve to indicate the site of inoculation. If there is an absence of true lesions in their vicinity, the membrane can be reported as "L—."

It was found that it was by no means unusual, when a batch of eggs was inoculated with virus-containing material, to find that one, or more, of the batch failed to show lesions. From this it follows that the absence of lesions from one membrane is not a proof of the absence of virus from the inoculating material. The standard adopted in Peshawar was to regard the absence of lesions from at least three membranes as presumptive of the absence of virus from the inoculum. It also happened that some eggs, although apparently healthy when inoculated, were found on opening to contain a dead embryo. In order, therefore, to ensure a conclusive result, at least five and, if possible, six eggs were inoculated in each batch.

#### GRINDING OF LESIONS.

This was also carried out in the glass chamber with full precautions against contaminations. The usual practice was to grind lesions, either in pairs, or all the lesions in one batch together. The tube containing the lesions in glycerine water was emptied into a Petri dish and, with a sterile forceps, the lesions were picked up and transferred to a sterile pestle and mortar. A little nutrient broth, papaine broth, or Tyrode solution was added in the amount of approximately 2 c.c. to each lesion, together with a small quantity of glass sand (the equivalent of three to four "knife points") and the lesions ground thoroughly. After grinding, the liquid portion was transferred to a sterile test tube by means of a capillary pipette and stored in the ice chest. This represents "passage virus" which is used for further inoculations, either undiluted or with the addition of an equal quantity of distilled water.



## NEUTRALIZATION TESTS.

It has been shown that convalescent serum from many of the diseases produced by viruses possesses antibodies against the causative virus. The method used in Peshawar for demonstrating this antibody effect was that described by Shortt *et alia* (1938), by inoculating eggs with a mixture of convalescent serum and virus and noting whether the lesion producing power of the virus appears to be neutralized. The convalescent serum was first tested by egg inoculation to ensure that, of itself, it produced no lesions. Equal quantities of serum and virus (about 16 drops of each) were then mixed and left in the incubator at 37° C. for thirty to forty minutes, after which the mixture was used to inoculate eggs. Control inoculations were also carried out, using as an inoculum either pure virus or a mixture of normal serum and virus. The absence of lesions from the test eggs and their presence in the controls was evidence that the convalescent serum possessed a neutralizing power.

## THE HISTOLOGY OF LESIONS.

If required for histological examination, the membrane is spread out in the Petri dish and examined without the addition of glycerine water. If lesions are present they should be covered at once with fixative fluid and subsequently double-embedded in celloidin and paraffin and sectioned at right angles to the surface (Shortt *et alia*, 1936). If it is desired to make a detailed study of the histology of the developing lesions, a large batch of eggs is inoculated, from which one or more eggs are opened at daily (or more frequent) intervals over four to five days and the lesions extracted, fixed, and sectioned.

Only a brief reference can be made to the actual histology of the lesions, but the changes seen appear to vary only very slightly with different viruses. The chorio-allantoic membrane may be taken as consisting of three layers, from without inwards, i.e. ectoderm, mesoderm, and entoderm. When a lesion is sectioned all three layers show thickening and proliferation of their cells in which inclusion material can be demonstrated by suitable staining methods. The outermost portion of the ectoderm may be necrosed off in the manner of a small ulcer. At present it appears doubtful whether any virus may be recognized, with certainty, from the microscopical appearance of its lesions.

## LESIONS PRODUCED BY OTHER CAUSES.

It will not be out of place to refer to the question of "pseudo-lesions," i.e. lesions produced by factors other than the presence of viruses. Pandit, Sanjiva Rao and Shortt (1938) investigated the response of the chorio-allantoic membrane to inoculation with a large number of substances of various kinds, and found that aluminium gel alone of the inert substances, and bacteria, produced lesions in eggs which were similar to those produced by known virus infections. The evidence to date suggests that the great majority of lesions produced by the inoculation of serum, and other body

fluids, are due to the presence of a virus. Those produced by other causes are mostly due to trauma or bacterial infection, of which the traumatic lesion is small in size and is not "passagable," i.e. if ground and inoculated into other eggs no lesions will be produced. The lesions mentioned above as being produced by aluminium gel were not passagable. Bacterial lesions, provided that the infection is not powerful enough to kill the embryo outright, usually appear as irregular soft-edged thickenings, varying considerably in appearance in different eggs in the same batch, and from which cultural tests will usually reveal the contaminating organism. Bacterial lesions are passagable.

It thus appears that if lesions are produced by serum from patients suffering with fever and these lesions conform to the appearance of virus lesions, are sterile on test and are passagable, there is fair evidence that the disease is due to a virus. More definite proof is obtained if, from subsequent tests, the virus is found to be neutralized by convalescent serum collected after an interval of six weeks, or more, from the date of onset of the original attack.

#### COMMENTARY.

It has not been possible to give more than a brief introduction to the culture of viruses on egg membrane, but it will be realized that the potentialities of the technique cover a very wide field. Reference has already been made to its possibilities as a means of diagnosis and in the investigation of diseases of doubtful ætiology. Even more important, if still somewhat remote, is its possible use in the production of antigen for immunization against virus diseases. Only one of the many methods of inoculation is described, and little has been said of the specific macroscopic and histological appearances produced by different viruses. For further details of these and similar matters, reports published by workers on various virus diseases should be consulted. References to some of these are included in the text, and particular attention is directed to the papers of the Guindy workers and to Burnet's admirable monograph. For those who wish to pursue the subject of the propagation of viruses by tissue culture, a concise account of the method is given by Cameron (1936).

#### ACKNOWLEDGMENTS.

I have to express my thanks to the Secretary of the Governing Body and Scientific Advisory Board, Indian Research Fund Association, for permission to submit this paper for publication. The work described was carried out in connexion with the Peshawar Section of an Inquiry into Sandfly Fever for which the Association made a special grant over a period of two years. I have also to thank Lieut.-Col. H. E. Shortt, I.M.S., Director, King Institute of Preventive Medicine, Guindy, and Officer-in-Charge, Sandfly Fever Inquiry, for his assistance in the preparation of this paper and to acknowledge, with gratitude, the trouble taken by him and his assistants, Dr. C. G. Pandit and Dr. Sanjiva Rao, in instructing me in methods of virus culture.

## 222 *Technique of Virus Culture on Chorio-Allantoic Membrane*

Thanks are also due to Major R. N. Phease, R.A.M.C., Major E. H. Hall, R.A.M.C., and Major T. C. Puri, I.M.S., for the hospitality of the District Laboratory, Peshawar, during their respective tenures as D.A.D.P., Peshawar District, and to Colonel J. B. A. Wigmore, late R.A.M.C., for his helpful criticism of the subject matter.

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### APPENDIX.

#### SUGGESTED LIST OF EQUIPMENT FOR EGG INOCULATION WORK.

(N.B.—This list does not include articles normally available in a laboratory, such as ordinary glassware, bacteriological media, etc.)

- Glass chamber—as described in text.
- Dark chamber—as described in text.
- Viewing lamp—as described in text.
- Viewing tube—as described in text.
- Incubator, fitted with egg boxes if necessary.
- Cutting drill (Dental—A.C. and D.C. motor), with fourteen inch bracket and fitted with carborundum discs, 1 inch diameter.
- Pestles and mortars, 3.
- \*Cataract knives, 4.
- Scissors, straight, fine pointed,  $4\frac{1}{2}$  inch, pairs, 2.
- Scissors, curved, fine pointed,  $4\frac{1}{2}$  inch, pairs, 1.
- Forceps, straight, fine pointed, 4 inch, pairs, 1.
- Forceps, curved, fine pointed, 4 inch, pairs, 2.
- Forceps, straight, blunt pointed, 6 inch, pairs, 2.
- Paraffin wax ( $60^{\circ}$  C.).
- Camel hair brush.
- Carbolic acid (3 per cent.).
- Absolute alcohol.
- Glycerine water (50 per cent.).
- Glass sand.

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\*Cataract knives which have become unserviceable for surgical work may be used for this purpose. In India a supply of such knives can, almost always, be procured from the local Civil Hospital.

## SOME OBSERVATIONS UPON THE WORK OF A MOBILE SURGICAL TEAM.

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THESE observations are based upon experience gained as a surgeon, in charge of a surgical team, sent from a Base Hospital and temporarily attached to a Casualty Clearing Station in Belgium, which carried out its work during the retreat from Flanders.

### THE NATURE OF THE CASES BEST TREATED IN A C.C.S.

These can be considered in three categories. Firstly, those cases of great urgency, e.g., severe hæmorrhage, recent wounds of the chest and abdomen which require treatment to save life, and recent compound fractures which require immediate treatment to prevent infection and so to diminish the period of convalescence. Secondly, abdominal wounds of forty-eight hours standing or longer with established peritonitis, and compound fractures and wounds admitted long after they had been sustained which were obviously heavily infected. Thirdly, the comparatively minor wounds which were nearly always inflicted by high explosives and were therefore either actually or potentially infected. Cases in the first and third categories clearly needed treatment in the C.C.S., either on account of their urgency or, in the minor wounds, to enable them to be restored to their units as fighting members with the least possible delay. With regard to those cases falling in the second category, towards the latter part of our stay in Flanders it was felt that it would have been a sounder policy to have evacuated them direct to the base on the count that the abdominal wounds were already the seat of peritonitis, that reparative surgery had little place and that the only hope for them lay in the possibility of the infection becoming localized; the infected fractures being already immobilized on splints and successfully combating the infection by natural means would have been better treated at the base in order to avoid transport after proper treatment had been instituted. Wide excision of such wounds with fixation in plaster of Paris as advocated by Trueta was not used because the wounds were several days old, the infection was localized and because evacuation to the base was usually carried out on the following day or at the longest on the second day and it was thought that the use of a complete plaster cast after such a wide excision in a patient who was to be removed from a surgeon's care for an indefinite number of days was fraught with danger. At the outset much time was spent on both varieties of case in this second category (particularly on the abdominal wounds), and, as the concentration of wounded was such that many of the minor wounds could only receive treatment after a considerable wait, which unfortunately

## 224 *Some Observations upon the Work of a Mobile Surgical Team*

resulted in some of them developing gas gangrene, it was felt that if the minor cases had been given priority not only would their convalescence have been shortened but in some of them both life and limb would have been saved. The rapid evacuation of the cases was the controlling factor in deciding the line of treatment which was taken in all the patients.

### THE INFECTED WOUND AND THE INCIDENCE OF GAS GANGRENE.

In the large lacerated wound, due to high explosives, rapid infection with disintegration and a foul discharge was the rule. In some cases this condition was difficult to differentiate from gas gangrene until after the toilet of the wound: the absence of the characteristic odour of gas gangrene was notable. In one or two instances very extensive wounds of this nature had been labelled gas gangrene on admission, and in view of this diagnosis and the site of the injury precluding surgical intervention they were considered to be beyond the help of the surgeon. When the dressings in these particular cases were renewed two or three days later it was obvious that the diagnosis of gas gangrene was incorrect.

A sulphanilamide pack, after the excision of the wound, was used in one or two patients where the site of the wound was such as to make amputation impossible and in one patient with a wound of the groin, who had been retained in the C.C.S. for three days, gas gangrene did not develop although in this same patient one arm had been amputated for a condition which, clinically, was undoubtedly fully developed gas gangrene. In view, however, of the difficulty in differentiating true early gas gangrene in these grossly infected wounds, it was felt that this case could not be adduced as proof that the sulphanilamide pack had prevented the development of this complication.

It was our misfortune in the latter part of our stay in a certain hospital where the lack of water and of light, and the fact that work had to be carried out in cellars (where proper sanitation was impossible) owing to the incessant enemy air attacks, to be faced with the difficulty of dealing with several cases of gas gangrene after our supplies of serum and sulphanilamide had been exhausted and amputation was no longer feasible. Even under these conditions, however, it was interesting to note that there was apparently no cross infection from one patient to another although the stench in these underground compartments called to one's mind the descriptions of the hospital wards in the pre-Listerian era when hospital gangrene was rife.

### WOUNDS OF THE CHEST AND ABDOMEN.

Without exception all wounds which had pierced the pleura that were brought in for treatment were bullet wounds and had been admitted soon after their infliction because presumably those men who were unable to be brought in early and had an open chest wound had died. The use of positive pressure oxygen followed by gas anæsthesia produced dramatic

recovery even in desperately ill patients, which recovery was maintained once the holes in the chest wall had been effectively closed. This type of case clearly requires treatment at a C.C.S.

Most of the abdominal injuries seen at the C.C.S. already exhibited peritonitis as they were of forty-eight hours standing at least and little help could be given to them. On the other hand gunshot wounds of the abdomen, principally in aviators, could be satisfactorily dealt with and again called for the presence of a C.C.S. It was particularly notable how very few of these cases required gut resection and although multiple perforations of the bowel were seen most of them could be safely invaginated and stitched. The high incidence of abdominal injury which attended wounds of the buttock was particularly striking. As in several of these cases the wounds were apparently mild ones and as the possibility of penetration of the abdomen had presumably not been foreseen, it was found that by the time they were admitted to the C.C.S. peritonitis had already established itself.

#### INJURIES OF THE HEAD.

It was found that injuries of the head could be divided into three categories, namely, the minor scalp wound, the penetrating wound and the depressed fracture with hernia cerebri. Beyond toilet of the wound in the last group no treatment was carried out and it was felt that these cases would have been better evacuated direct to the base. The minor scalp wound was adequately treated in the field ambulance and could also have been evacuated direct to the base. Of the remainder, in whom an operation of any extent was required, it was thought that the conditions and the equipment of a C.C.S. were hardly adequate to deal with such cases and moreover it seemed hardly justifiable to expend as much time on one case as the technique of the modern cerebral surgeon demands when so large a number of men urgently required assistance. Surely direct evacuation to the base for treatment by a neuro-surgical specialist with the resources of a base hospital would have been the best course.

#### THE USE OF STORED BLOOD AND PLASMA.

Too high a commendation cannot be given of the excellent work carried out in the resuscitation ward with the use of stored blood as supplied by the blood transfusion service whose apparatus proved to be most effective. It must have saved many lives and have rendered operative treatment so much less hazardous for the patient than it would otherwise have been. Stored blood was used for all cases of severe hæmorrhage and for pre-operative shock. At first further transfusions were given for post-operative shock but later, except in those cases which were definitely deficient in blood, post-operative shock was combated by the use of plasma with very satisfactory results. On no occasion was any untoward reaction from the use of either stored blood or plasma noted.

## THE USE OF INTRAVENOUS ANÆSTHESIA.

For those cases with minor wounds or in whom surgical procedures were neither lengthy nor extensive pentothal proved a wholly admirable anæsthetic but its use was entirely contra-indicated in the case of shock. In these cases the lowering of the blood-pressure attendant upon its use was such that serious and most dangerous collapse supervened. The intravenous anæsthetic so widely adopted by the French surgeons was narconumal which appeared to give as effective an anæsthesia as pentothal of perhaps a rather longer duration and, according to its advocates, was almost devoid of toxic properties. As the product was not available for use in the C.C.S. a strict comparison of the two drugs could not be carried out.

## CONCLUSION.

It is urged that patients already infected, owing to the length of time elapsing before their admission and also the large majority of head injuries, would lose nothing by direct evacuation to the base whilst such a procedure would lighten the load upon the C.C.S. considerably.

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## THE ORGANIZATION AND RUNNING OF AN AMBULANCE TRAIN.

By MAJOR C. C. H. CHAVASSE,  
*Royal Army Medical Corps.*

THESE notes on the loading and organization of an ambulance train are put together, because, as far as I can gather, there is little information except that contributed to the Medical History of the Great War by Nicholls. So, I have put down purely my own ideas as a help to those who may find them useful at some future date.

It must be realized that an ambulance train is a "carrier" and not a hospital. Diagnosis and the initiation of detailed treatment are not the work of the medical staff on a train. It is their job to see that each patient, while being conveyed from one point to another is in comfort to prevent aggravation of his condition if possible, to ease his condition as much as it is in their power, to treat any complication which may arise, and to continue certain treatments already initiated, e.g. the administration of certain drugs.

On arrival at the loading station, and before any ambulances have arrived, the Embarkation Medical Officer should be able to give a rough estimate of the number of cases to be expected. The following information (if obtainable) in addition is required :—

(1) The number of infectious cases—because these vary for the time of the year and may mean a rearrangement of the plan.

(2) The number of officers.

(3) The *distribution into walking or stretcher cases*. Walking cases are likely to greatly outnumber stretcher cases during quiescent periods—more than can be accommodated in "E" Coach. So, if the stretcher cases do not fill all the bunks, walking cases can be accommodated in other coaches. Then, again, not all the ambulances from various casualty clearing stations or field ambulances arrive at the same time, owing to the distance they have to come; so all the bunks must not be filled with walking wounded till every ambulance has arrived, and the lying cases have been accommodated.

The E.M.O. during loading, should assist in keeping the ambulances from crowding up the station yard, and see that they drive right away as soon as they have discharged their contents.

### LOADING.

Before working out the plan for loading the train, the following points should be borne in mind :—

(1) The necessity for *the isolation of seriously or dangerously ill cases*



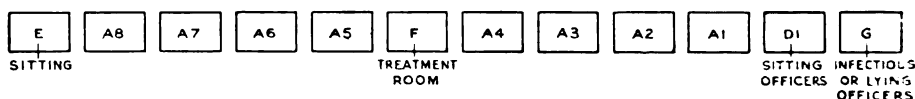
in each coach : so that a constant watch can be maintained, and a case placed in a coach where his injuries may be easily attended to.

(2) *A simple classification of the coaches*, e.g. medical, surgical, infectious, etc., is required.

(3) *Rapid loading* so as to prevent congestion of ambulances in the station yard, is necessary.

(4) *Enumeration of cases* should be carried out, so that each coach can be filled to capacity without an officer having to go down the train to find this out.

The train (the coaches of which are labelled as below) should be planned in the following manner :—



The more seriously ill cases should be nearer the treatment room, so start from A4 for acute surgical cases and from A5 for acute medical cases and work outwards, filling each coach with surgical or medical stretcher cases. During the quiescent periods, where walking cases greatly outnumber the stretcher cases, keep Coach "E" for V.D. or skin diseases. Coaches A7 and A8 are to be used for surgical and medical walking cases respectively. Their capacity can be temporarily or permanently increased by turning up the middle bunk and sitting three on the bottom and one lying on the top. But this is not to be recommended as a permanency, if avoidable, as the gangway becomes obstructed and definitely hinders the passage of food by the orderlies from the kitchen coach. But until loading is completed and it is known how many spare bunks there are in other coaches, it is a useful temporary measure.

The ambulances arrive at the station and are met by the receiving officer with his clerk who carries a plan of the coaches on a board :—

Coach									Capacity.
G	{	Sitting	..	..	..	..	..	..	—
	{	Lying	..	..	..	..	..	..	24
	{	Sitting	..	..	..	..	..	..	18
D1	{	Sitting	..	..	..	..	..	..	—
A1	{	Sitting	..	..	..	..	..	..	46
	{	Lying	..	..	..	..	..	..	36
A2	{	Sitting	..	..	..	..	..	..	46
	{	Lying	..	..	..	..	..	..	36
A3	{	Sitting	..	..	..	..	..	..	46
	{	Lying	..	..	..	..	..	..	36

The driver of the ambulance may have a piece of paper with the following information of the contents of his ambulance :—(a) Number ; (b) walking or stretcher cases ; (c) officers or other ranks ; (d) surgical, medical, infectious.

If the information " seriously or dangerously ill " is also supplied.

this greatly facilitates the loading. Failing this information, personal inspection of the cases in the ambulance is necessary. With walking cases, the cards can be rapidly passed to the end of the car ; in the case of lying cases, the cards must be examined and should be marked in blue pencil with the diagnosis in block capitals.

As the cases in each ambulance are consigned to a coach, the cards are marked clearly, and the clerk informed, who marks off the number on his chart, and directs the driver to the coach to which he is to deliver his cases. All this should take only a few seconds. There is no need to read the cards if they are properly marked, and if there is an orderly to open the door of the ambulances as soon as you are ready, no delay should occur.

Where the ambulance driver gives the information that they are all walking cases, he can drive straight to A7 coach, unload and drive away. A second medical officer can sort them into the respective wards of 7, 8 and "E". All that need be noted is the gross number on the chart. The enumeration of the cases is important when approaching the end of the convoy. Odd beds are more easily found for the last few cases, and the capacity of the train can be fully utilized. Also at any time during the loading the E.M.O. can be informed of the state of the train.

I have found that it is advisable to keep "E" Coach for V.D., skin and mental cases with escorts till the end for reasons already stated. Where, through the information of the driver, seriously or dangerously ill cases are isolated, the orderly can inform the third medical officer who is watching the unloading of the ambulances, so that special care may be taken with the cases. He can see where the patient is placed in the coach—middle bunk and injured side outwards—and indicate any treatment necessary immediately, e.g., morphia injection, added warmth, etc. Where the receiving officer is not supplied with information by the driver, the advisability of examining each stretcher case is still a debatable point. Quite obviously, it could not be done where rapid evacuation is essential, or the danger of air bombardment present. But otherwise the points in favour of examination are that the seriously ill are found at once and can be marked ; any patient who would have his life endangered by a passage in the train (considering the length of time and the treatment that can be given) should be returned to a C.C.S. Certain cases lying in a C.C.S. may appear perfectly fit to travel until moved, and then, as a result of a long or jolting journey in an ambulance, may rapidly deteriorate and should be returned to the nearest C.C.S. All this takes a very short time if the cards are marked clearly.

Another point in the plan of loading—it should be such that it can be quickly altered or modified, if, for instance, wounds and surgical cases greatly outnumber medical cases. Then, coaches previously designated medical can be utilized. It is necessary to give all stretcher cases precedence, and if all cannot be taken the walking cases and those with minor complaints

must be returned. If the loading is likely to be difficult, the E.M.O. should be informed and he will make arrangements for the return or disposal of the excess cases.

Where loading is taking place during, or as a result of recent fighting, in addition to the already mentioned speeding up, it may be necessary to carry cases in a worse condition than in quiescent periods. In fact, the only cases it is justifiable in these circumstances to send or return to a C.C.S. are those who require any special treatment (e.g. chest wounds for operation, injured limbs requiring operation, splintage or arrest of hæmorrhage) and for whom there are not the facilities necessary for such treatment on a train.

An officer might be tempted, with the well-equipped treatment room, to take on more cases than he can look after efficiently. A train in motion is not a good vehicle in which to seek for a bleeding point or an artery for transfusion and, with 360 or more cases—and possibly a high percentage of badly wounded—the time of the three medical officers would be fully occupied in relieving pain, adjusting splints, and generally watching the patients, without undertaking difficult operations.

The changing of dressings is also a debatable point. With some cases there is no doubt, but with others there is the question whether this does more harm than good. But if the following rules are observed, a decision can be easily made :—a train is not a place where anything like perfect asepsis or anti-sepsis can be practised ; secondly, it is a carrier, and therefore if there is a risk of further surgical treatment by removal of the dressing, it should not be changed ; thirdly, by removal of the dressing the risk of hæmorrhage may be increased or even started in certain cases.

During active operation there may be cases who have not been through a C.C.S. and come direct from a Field Ambulance. The ambulance drivers may not have been informed of the contents or the condition of the patients in their ambulances ; these cases should be noted as likely to be in need of further treatment ; re-application of splints, or where improvisation has had to be used, the replacement with a more useful splint. So, if possible, a rapid survey of each of the ambulances may be excusable. In these conditions, as surgical cases will of course be in the majority, and also stretcher cases, several coaches should be loaded at once, no attempt should be made to fill each coach before starting the next as is usually done in quiescent periods and with light loads.

There is a further classification of surgical cases, namely, into fractures, abdominal cases, etc., but, as far as I can see, this cannot be done in the loading, and can only be notified for each coach in the disembarkation state (*see below*).

Another difficulty I have found in loading is the reservation of a coach for infectious and stretcher cases for officers. "G" coach can be used for either, and is divided into separate compartments with sliding doors. In the period of the year when infectious cases are prevalent, there will

certainly be more than twenty-four (the capacity of "G" coach) and "A1" will have to be used. Then, if the infectious cases are few, you may be able to utilize half of "G," reserving the rest for officers. Then, again, it is difficult—if not impossible—when utilising the compartments of "G" coach to keep separate infections in each compartment, because you would waste beds. And, anyhow, if they are carried in "A1," they have to be under the same roof.

All this seems common sense, but it does point out how useful it is to know before starting the number of officers and infectious cases, and the necessity not to waste empty beds and not to delay the embarkation.

The unloading of the stretcher cases from the ambulance to the train should be under the observation of the third officer and the N.C.O. of each coach. Since the loading party may be inexperienced, it is necessary to see that there is care in handling, and to watch that no arm or leg is outside the stretcher during the operation.

Also, the officer should see as many of the seriously ill cases as possible placed in their right bunks and in such a position that their wounds or splints can be easily attended to if necessary. He also may have to give orders for a treatment to be prepared, so that he may carry it out as soon as opportunity arises, e.g., injection of morphia, catheterization, etc. The cases less injured or not seriously ill should be placed in the top and in the lower bunks, the middle being reserved for those in a more serious condition. The officer in charge of the loading should also see that ambulance doors are not unnecessarily opened too soon, or in unloading left open too long—especially in cold or wet weather, so chilling the patient or exposing him to the elements. The N.C.O. or senior orderly can help in the classification of his ward in the early stages by keeping limb injuries to one carriage end and abdominal in another, if their condition is obvious.

#### DURING TRANSIT.

On completion of loading, all coach doors should be closed and secured. This is necessary with walking cases, as there is a liability that men will leave the train for the nearest estaminet if the train is not moving off at once. Also, mental cases may make a dart for an open door. But, before the train moves, it is advisable to unlock the doors in case of an accident or rapid evacuation of the train becomes necessary, e.g. from fire.

The medical officers should start, one at each end of the train and proceed to read through each man's card, and examine those patients who require it. The information they are seeking is :—

(1) The number seriously ill ; (2) the treatment needed or likely to be required during transit ; (3) the diet necessary ; (4) detailed classification for each coach, or seeing that the card is clearly marked outside for the disembarkation list to be made later.

A useful method of marking cases is from an idea for which I am indebted

to Lieutenant-Colonel Lloyd Williams of the Hospital Carrier "Brighton"—that is, of brightly coloured clothes pegs clipped to the medical card, the latter being hung at the head of each patient's bunk. The colours required are : (1) red, for "seriously ill"; (2) white, for "nothing to be given by the mouth"; (3) black, for "fluid diet."

The senior officer usually attends to the officers' cards and carries out their treatment, or helps with any urgent treatment required, while the two other officers are going through the cards of other ranks.

The officers examining the cards should ensure that each card is clearly marked outside "S" or "M" (surgical or medical), "C" for chest injuries, etc., etc. If not thus marked the officer should do so with a blue pencil. This completed, the orderlies, knowing the diets for their respective coaches, can proceed with the meal.

Two nursing orderlies are posted to each coach, with a general duty orderly to fetch and carry the food from and generally assist in the kitchen. One orderly only is necessary after "lights out." The nursing orderly will report any diets other than normal to the ward master, and also any drugs ordered by the medical officer.

When the examination by the medical officers is completed, the commanding officer of the train should, either from his examining officers' notes or from his own, correlate the contents of the whole train for the disembarkation list.

Here is an example :—

"G" Infectious	24	..	..	8 Cerebrospinal Meningitis.
				10 Scarlet Fever.
				3 Measles.
				3 Diphtheria.
"A1" 36 Surgical	..	..	..	12 Fractures "F".
(Lying—30)	..	..	..	14 Abdominal "G".
(Walking—6)	..	..	..	4 Neurological Wound "N".
				6 Ear, Nose and Throat "E".

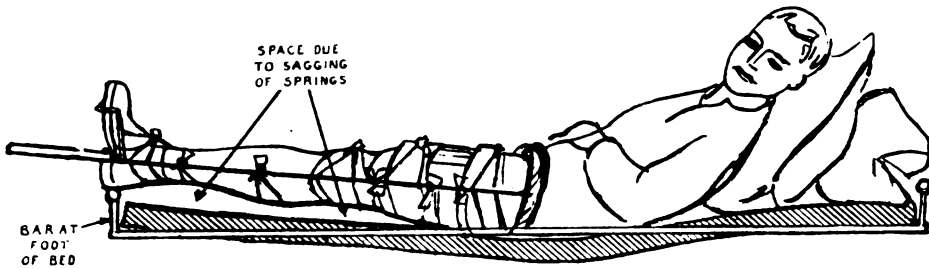
After completion of the tour of inspection, the duties of the medical officers must be detailed in accordance with the amount of work likely to occur. But one medical officer should always be on duty, making frequent rounds of the wards during the night to (1) see to the comfort of the patients; (2) give medical and surgical treatment needed; (3) see that the night orderly is doing his duty in watching the patients and quickly responding to their desires, e.g., for bed-pans, water-bottles and drinks.

A second medical officer should be at close call, so that he can immediately go to the assistance of the first, should this officer require him during the night where there is a full load.

The medical officer on duty should see that the straps on the outside of the bunks are fixed before men settle off to sleep, or before, if a patient is restless or subject to fits. This inspection is likely to be omitted with

slightly injured or walking cases; but many cases are restless in their sleep and run great risks of falling off the top tier.

Cases of fractures of the lower limb make it very necessary to see that the splint is properly supported, that the plastered limb is raised (especially if the splint has only recently been applied), and that the bandages around the splint are properly applied—not too tight or too loose. Otherwise, in the case of the lower limb the leg is liable to sag and the fractured bone become displaced.



The above illustration shows a rather exaggerated diagram of what is likely to occur. Unless the space shown in the diagram is packed or eradicated, a loosely applied Thomas' splint is liable to cause displacement. Fracture boards may be improvised as another method of securing an equable support for the limb.

The position of the patient in bed should be watched—for example, those requiring the upper or lower half of the body to be raised. Bed rests are available, and the position of the patient should be such that he receives the full benefit of such an appliance.

The nursing orderlies, besides feeding and looking after the requirements of their patients, should be warned to watch for hæmorrhage in the cases where it is likely to occur, for signs of shock or collapse and for signs of pain or aggravation of such a condition.

Shock remedies applicable in a train, besides the injection of morphia, consist of added warmth in the form of hot bottles, extra blankets, hot drinks, glucose and lemon. Any emergency should be dealt with at once, e.g., gross hæmorrhage. Here, it is justifiable to remove a dressing and either pack or redress the wound. Further steps may be necessary to locate the bleeding point.

The nurses' duties during the time of transit are to reassure a patient whose shock is aggravated by fear or apprehension. I have not mentioned the three nurses included in the establishment before, because their duties must greatly depend upon their training and tact. But their assistance in the treatment of patients, the administration of medicine and the quietening of restless or distressed patients, is a great contribution and a very real one for the benefit of the whole train. The sister-in-charge looks after the sick officers, whilst the other two nurses accompany the medical

officers on their initial rounds—one to each officer—and assist in carrying out any treatment ordered by them. One sister remains on duty all night always, and possibly two when a large number of patients are found to be in a serious condition. In fact, there is every possibility that all the officers and nurses will be on duty the whole of the night.

In the morning, as many patients as possible should be washed before disembarkation. Here, the nurses should assist the orderlies, especially in wards where there is the greatest percentage of helpless patients.

The advisability or ability to do intravenous transfusions or rectal infusions depends upon several factors. The movement of the train with sudden stopping and starting makes it doubtful whether a needle could be retained in a vein at all. There is also the difficulty of finding a vein on a man in a middle or higher bunk. But when a train is detained for some time in the siding after embarkation, intravenous injection may be possible in cases where obvious benefit would be gained.

*Medical Cases.*—The general nursing duties are carried out—position in bed is important, a free supply of air is gained by placing a man in a bunk near the windows. The other work consists in the carrying on of continuous treatment, such as the administration of M & B 693 (Dagenau), injections of insulin, etc., and the giving of sleeping draughts and cough mixtures.

Diet is a subject which should be settled before the patients arrive. The normal diet: the meals to be provided will be tea, supper and breakfast, and a written diet should be settled with the corporal cook from the stores being carried. The difficulty one might experience is shortage of bread, especially if the train has been some time in "garage" away from a R.A.S.C. Depot. But every C.C.S. should supply at the Collecting Station the half-day unconsumed ration, and in this the E.M.O. can assist by seeing that the ration is obtained.

The other diets do need some forethought the day before loading. Jellies can be made, and glucose and lemon drinks prepared. For the officers, glucose, lemon, and egg flip and custards can be made in addition.

Owing to the small size of the kitchen and the large number of patients that may be carried, certain things must be prepared beforehand, as there will be no time after the patients have arrived. These extras do not amount to much, but they make a great difference to patients who are very ill, and who will principally benefit from the preparations of these extras in a liquid diet.

During transit, a nominal roll has to be made, showing every patient, his regiment and diagnosis, with a serial number. This is best prepared by having a separate sheet of paper for each coach, and marking it off into the 36 bunks. By this means mistakes are less likely and each coach can be checked as the list is completed. This roll is prepared by the orderly room staff.

## DISEMBARKATION.

This, unlike embarkation, does not affect the train staff to such an extent; embarkation must remain entirely in the hands of the C.O. of the train or an officer to whom he details it, unless chaos and inefficiency are to occur.

On arrival, the C.O. of the train should have ready his list of the contents of each ward, with any minor helpful details of each coach that he can provide. This he hands to the disembarkation officer.

There is one point of importance—where patients are sent from a C.C.S. with X-ray films or notes, these may be handed to you unsorted. It therefore greatly facilitates their distribution if they are rolled up and attached to each patient just before arrival at the disembarkation station.

During the unloading, train officers should see that the handling of patients, especially the seriously ill, is done with care, and that the proper exchange of stretchers and blankets is carried out with each ambulance before it is allowed to drive away.

On completion of the unloading of each coach, the orderlies and general duty men should start at once to tidy the beds, fold the blankets, and, if not already done, all eating and drinking utensils should be collected, washed, dried and stored away; ash trays should be emptied, and the white paint washed with warm soapy water from ceiling to floor; the lavatories and wash basins thoroughly cleaned and polished, all the bright work polished and the whole floor scrubbed thoroughly from end to end.

Any repairs required or breakages and the state of the water tanks should be reported to the ward master at once, and then the train will be ready, after replenishing both medical and ration stores and water, to return at once if required.

Another difficulty that may be encountered is officers' baggage. As the store coach is at the opposite end of the train to the officers' coach baggage stored there may cause great inconvenience to ambulances which have to turn to collect each officer's kit after loading. When there are few officers, their kit can be carried in the small guard's van at the end of "G" coach if it is not being used by the railway servants; if, however, this is not available, the French brake van may be employed, though this cannot be locked and there is a risk of loss which may entail the inconvenience of having to use the store coach.

It is very important to see that each officer gets all his baggage, as odd pieces may be left behind because officers may not have had time or been able to mark their own luggage. A system of coloured labels or chalks might be used to keep each batch together for unloading.

I have not entered into the organization before receiving patients or during times in garage, but I think an efficiently organized train, with strict discipline and constant training, plays a large part in its efficiency and in comfort to the patients when the various situations likely to be met with arrive, and when the train is used for what it is intended—namely, as a "carrier."



## THE UNCERTIFIED CHRONIC PATIENT.

BY CAPTAIN G. R. A. DE M. RUDOLF,  
*Royal Army Medical Corps.*

UNCERTIFIED chronic patients comprise a vast heterogeneous group of cases. Legally, they can be divided into voluntary and temporary patients and normal persons. Clinically, they can be given innumerable diagnoses.

*Diagnosis.*—The fixing of a diagnostic label is notoriously difficult as in many cases two or more diagnoses could be given. In these series the earliest or the most prominent condition has been used, but other clinicians would, without doubt, have given other diagnoses to some of the cases. The voluntary and temporary patients were diagnosed by Dr. E. Casson and so are definitely comparable with one another. The other groups are also comparable as they were all my own diagnoses. The cases were examined before the collection of the figures for this article and the diagnoses were made without consideration of the diagnoses in other groups. Although many of the depressives and maniacs may have been manic-depressives, they have not been placed in this group as the cyclothyme condition was not the most prominent symptom present at the first interview.

*Acute and Chronic Types.*—The exact definitions of the terms acute and chronic are not very clear, but I am regarding, arbitrarily, an acute condition as one starting suddenly and persisting for a few weeks only.

Few cases can be termed acute. Sudden onset of anxiety, acute attacks of mania and of alcoholic delirium may occur and approximately one-third of the temporary cases were of this nature. In the other groups the acute cases numbered so few that each series can be regarded as chronic in character.

*Type of Case.*—A review of the patients attending any one hospital may be entirely fallacious as regards giving a general idea of the nature of the class under consideration. The cases have been selected by those who have referred them and also by the reputation of the hospital in the locality, whether this is small or large. Consequently, in order to determine the nature of uncertified chronic psychological cases, the diagnoses from six groups of cases have been reviewed.

The cases were successive and unselected. The groups consist of voluntary and temporary patients, cases referred to a private psychological practice, patients seen for psychotherapy at the West End Hospital for Nervous Diseases, London, and patients referred from general practitioners and the honorary staffs of the Bristol Royal Infirmary and the Bristol General Hospital. The diagnoses of the voluntary and temporary patients have been taken from the records of Dorset House, Bristol, a nursing home

of 100 beds, of which 30 are approved under the Mental Treatment Act for the reception of voluntary, and, up to 5, temporary patients. My thanks are due to Dr. E. Casson for permitting me to use her figures. At the West End Hospital for Nervous Diseases, the cases are referred by the neurologists to the psychiatrists. If they are considered suitable they are then sent for psychotherapy. To Dr. Blachford, my late senior at the Bristol General Hospital, my thanks are due for permission to cite cases which have come to the department for mental diseases at that hospital.

*General Review.*—Table I demonstrates some striking points, of which

TABLE I—DIAGNOSES (PERCENTAGES IN BRACKETS).

Diagnoses	Voluntary	Temporary	Private	W. End Hospital	Royal Infirmary	General Hospital
Anxiety ..	4 (8)	0	20 (40)	11 (44)	22 (44)	15 (30)
Confusion ..	12 (24)	7 (28)	0	0	0	1 (2)
Depression ..	11 (22)	2 (8)	3 (6)	3 (12)	11 (22)	13 (26)
Schizophrenia..	9 (18)	5 (20)	4 (8)	5 (20)	2 (4)	2 (4)

the most prominent is the relatively high and constant proportion of anxiety cases in the private, the West End Hospital, Royal Infirmary and General Hospital groups. This type varied from 30 to 44 per cent of all cases. The absence of these cases from the temporary group and the low percentage in the voluntary group demonstrate that cases of anxiety do not usually require to be under any kind of order. The diagnosis of confusion was seldom made in private, West End Hospital, Royal Infirmary or General Hospital series, but formed about 25 per cent of the voluntary and temporary cases. In the combined temporary and private groups depressives form 7 per cent of the cases, but 23 per cent in the combined voluntary Royal Infirmary and General Hospital groups. At the West End Hospital they occupy an intermediate position (12 per cent), probably because many melancholics would have been eliminated as being unsuitable for psychotherapy. Schizophrenics vary from 16 to 20 per cent in the voluntary, temporary and West End Hospital groups, in the latter being chiefly slight types. In the private, Royal Infirmary and General Hospital groups they form only from 4 to 8 per cent of the cases. Secondary dementia is slightly more common in the voluntary group than elsewhere, and mania in the temporary cases. As these last were mostly acute cases, they can be excluded from this discussion. Hysteria was absent amongst the voluntary and temporary groups. The high proportion of delinquents, 3 of 4 and 2 of 4, in the groups of sexual aberrations and mental deficiency respectively, is of interest. These cases were referred from the Courts.

*Sex.*—Table II gives the distribution of the sexes. The voluntary and

TABLE II.—SEX DISTRIBUTION. (PERCENTAGES IN BRACKETS.)

	Private	W. End Hospital	Royal Infirmary	General Hospital	Total
M. ..	29 (58)	14 (56)	25 (50)	23 (46)	91 (52)
F. ..	21 (42)	11 (44)	25 (50)	27 (54)	84 (48)

temporary patients have been omitted as the Dorset House records are

biased towards the female side. This is partly due to males having been admitted in any numbers in the past three or four years only, and to the number of male beds being less than female.

The remarkably equal distribution of the sexes in the private, West End Hospital, Royal Infirmary and General Hospital groups would suggest that some definite selective action had occurred, were it not known that this were not the case. Table II suggests that either males suffer in a higher proportion than females from the conditions under consideration, or that males come for treatment more than do females, the female population of the country being greater than that of the opposite sex.

*Age.*—The age-distribution is shown in Table III, the ages being those at which the patients first came under observation.

TABLE III.—AGE DISTRIBUTION. (PERCENTAGES IN BRACKETS.)

Age-Group	Voluntary	Temporary	Private	W. End Hospital	Royal Infirmary	General Hospital	Totals
0—9 ..	0	0	0	0	1 (2)	3 (6)	4 (2)
10—19 ..	1 (2)	2 (8)	8 (16)	0	1 (2)	7 (14)	19 (8)
20—29 ..	9 (18)	5 (20)	13 (26)	14 (56)	13 (26)	6 (12)	60 (24)
30—39 ..	9 (18)	1 (4)	11 (22)	6 (24)	18 (36)	18 (36)	63 (25)
40—49 ..	6 (12)	4 (16)	8 (16)	3 (12)	5 (10)	7 (14)	33 (13)
50—59 ..	11 (22)	5 (20)	7 (14)	1 (4)	9 (18)	4 (8)	37 (15)
60—69 ..	8 (16)	4 (16)	0	1 (4)	3 (6)	4 (8)	20 (8)
70—79 ..	5 (10)	2 (8)	1 (2)	0	0	1 (2)	9 (4)
80—89 ..	1 (2)	2 (8)	2 (4)	0	0	0	5 (2)

At the West End Hospital there is a children's department, so that young persons are artificially excluded from the table.

The voluntary and temporary patients are fairly evenly distributed throughout the age-groups from 20 to 70 years.

In the private group the ages lie chiefly between 10 and 60 years, in the Royal Infirmary group between 20 and 60, and in the General Hospital series between 10 and 50. Of all cases combined 49 per cent were aged between 20 and 40 years.

*Summary of Tables.*—Tables I, II and III show that the sexes occurred in equal proportions and that the majority of cases coming for treatment were from about 20 to 59 years of age. The most frequent diagnoses were anxiety (29 per cent), depression (17 per cent) schizophrenia (10 per cent), and confusion (8 per cent). The other diagnoses were, in alphabetical order, chorea, cretinism, delirium, delusional psychosis, enuresis, epilepsy, exhaustion, fibrositis, hypothyroidism, hysteria, labyrinthine disease, mania, manic-depressive psychosis, mental deficiency, migraine, neurasthenia, neurosyphilis, paralysis agitans, paranoia, paraphrenia, post-encephalitic conditions, senile dementia, sexual aberrations, spinal hæmorrhage, tic, torticollis, and vocational guidance.

In one of the depressives Pick's disease was present, in another pellagra.

*Comments.*—Comments are made below on the most common conditions, and, in addition, on a few other conditions which have been specially studied.

(1) Anxiety : This may be shown by obvious signs of fear or by somatic symptoms, such as flatulence, nausea, pain or diarrhœa. In one case,

the last occurred for three days on each of two occasions when repressed memories of an accident rose into consciousness accompanied by fear. Flatulence is a frequent accompaniment of anxiety and pain may be localized in a region already the seat of organic pain. In a woman who had had an illegal abortion performed following illicit coitus unknown to her husband, severe pain developed over the vertex and the occipital region. A slight degree of cervical osteo-arthritis was found on X-ray examination, but it was insufficient to cause such severe pain, which was apparently due to guilt, unconfessed to her husband. The presence of physical symptoms of anxiety may be difficult to detect as in the case of a chronic alcoholic who gave a very detailed account of his past history. It was not until after about forty-five minutes, and then only on questioning, that he mentioned that he underwent attacks of "trembling" which consisted of palpitation and a "sinking feeling in the stomach."

(2) Depression : Although a diagnosis of depression is usually relatively easy, decision as to whether the condition is primary, e.g. a phase of a manic-depressive condition, or secondary or an anxiety or toxic state, may be difficult. The depression may be attached to anything, two very different subjects being a mistake made in buying a house, and a fear that an expected baby would be mentally defective.

Treatment depends upon the cause, but benzedrine, commencing with small doses of mgm. iiss, gives very good results in cases who are particularly depressed in the earlier parts of the day. Many cases improve with general hygienic measures, such as the correction of constipation, increased exercise and feeding, coupled with occupational therapy. The last is important in order to draw the interest of the patient away from the subject to which the depression is attached. The toxic group of depressives should be dealt with by surgical and other suitable physical measures, such as hydrotherapy and the use of ultra-violet rays from a mercury-vapour lamp combined with infra-red rays.

(3) Schizophrenia : The treatment of the uncertified schizophrenic may present several difficulties. The voluntary patient may leave when he has improved slightly after a few injections of cardiazol, before he has completed the full course. The discomfort of both cardiazol and insulin treatment may make the patient protest against further injections, although treatment is apparently less unpleasant with triazol 156. Fortunately, large numbers of schizophrenics show a steady, lasting improvement without these treatments, with good food, cheerful surroundings, and constant occupational therapy. The use of the hands appears to be of great importance. One case, a clergyman's son, was advised to give up working for examinations and use his hands. He entered an engineering works as an apprentice. Although he continued to live at home and no other treatment was given, he improved so much that, within a month, his own doctor considered him normal. In reality, he had not fully recovered.

Psychotherapy may be of definite value in schizophrenia and may modify

and improve the condition, but, in my hands, it has never produced a good remission, even temporarily.

Finally, mental defectives may develop schizophrenic symptoms, the schizophrenia being superimposed upon the deficiency. The proportion of defectives in which this occurs is not high. Dr. J. Lyons and the writer were able to find only about 1.6 per cent of defectives with schizoid symptoms amongst the 600 mental defectives of all ages and both sexes in Hortham Colony. This estimate is, no doubt, low. Many cases would have been sent direct to the mental hospital. It gives an indication of the proportion of defectives, who without being typical schizophrenics, may possess one or two schizoid characteristics. Such cases need the training given to defectives in addition to any chemical treatment or psychotherapy that may be used.

(4) Confusion: The diagnosis of confusion usually presents little difficulty. The amount of deterioration or dementia present can be estimated by means of Babcock's method of the use of vocabulary tests in conjunction with estimates of intelligence.

The causes of confusion may be difficult to determine, but the most common are toxic and arteriosclerotic. Cerebral tumours are a less common cause. Psychotherapy may be of value in certain cases, but I have no personal experience of its use in cases primarily confusional in character. The treatment of the majority of cases should consist of general hygienic measures, the removal of toxic foci, and, possibly, the attempted lowering of high blood-pressure.

(5) Post-encephalitic conditions: In addition to the well-known changes of character that may follow encephalitis epidemica in children, the adult cases often show depression and fear, and are frequently over-emotional. Treatment with some of the standard methods, as tincture of stramonium in 45 or 60 minim doses, improves both the physical and psychological states. My results with the Bulgarian treatment on a few cases, but over periods of up to 500 days, strongly suggest that the method of preparation is the important factor operating in cases reacting well to this therapy. Greater improvements were obtained in patients treated with B.P. Belladonna root prepared by the Bulgarian method than by the use of the Bulgarian mixed Solanaceae roots prepared by the same method.

(6) Sexual aberrations: Although the diagnosis of these cases is usually obvious, the causes may be obscure. Quite superficial treatment will correct many cases, but prolonged deep psycho-analysis is necessary in others. A few sessions cured a patient who felt inferior, and, in consequence, exposed himself to prove he was a fully developed man. Another case who exposed himself two or three times a week, required over twenty interviews before he was free from the urges for even three weeks.

(7) Mental deficiency: The diagnosis of deficiency is of importance. Many of the higher grade are missed and break down in their conduct because they are expected to do work for which they are incapable. They

in consequence, feel inferior and so break out in primitive ways, by violence, theft or other methods of showing their importance or of "getting even" with individuals or the community. An early diagnosis gives time for treatment and training so that the defective can be made to feel proud of that which he can achieve and so feel competent, even if in small matters only.

Some modification of the Binet-Simon group of tests is usually used for an estimate of that evasive quality known as intelligence. Burt standardized the American Stanford Revision of the tests for English children, but a revised form of the series of tests was issued three years ago in America. This revised form is at present unsuitable for English subjects as it has not yet been standardized for this country.

A very useful, rapid test for higher-grade defectives is Kent's Oral Emergency Test, C. J. C. Earl's English modification. The test tends to give results slightly lower than those of the original Stanford Revision of the Binet Simon Tests.

Performance test such as Koh's blocks, Healy's pictures, the Manikin and the Porteus Maze test, are valuable, C. J. C. Earl having shown that performance tests do not necessarily run parallel with other tests of intelligence. The testing for Spearman's specific or group factors, the last overlapping one another, may give useful information, and, although the influence of the specific factors is probably of greater clinical importance, an estimate of *g.* may be of much value for general purposes. The Accomplishment Quotient  $\left( \frac{\text{Educational Age} \times 100}{\text{Mental Age}} \right)$  when compared with the I.Q. will give

indications as regards school progress, as in reading, spelling, English, arithmetic and writing. Finally, tests for aesthetic sense, which appear to be basic and independent of experience and training, may be used.

When an estimate has been formed of the capabilities of the individual, suitable work can be selected for him, but success or failure will be dependent upon the use made by the defective of his intelligence. He will use it to the full only if his temperament and character are suitable and his emotions are favourably stimulated. Unfortunately, tests of temperament and character have low validities and, at present, the assessment of temperament is an art rather than a science.

(8) Delinquency: Delinquents who do not break the law from conscious motives may do so for many reasons, such as being unable to appreciate the wrongfulness of their actions or feelings.

A somewhat unusual instance of this is that of a man driving with undue care. He drove three motor-bicycles and one horse into stationary objects. He suffered from *petit mal* attacks of a few seconds duration. More common instances are those of rick firing by defectives who like to see a "nice fire," but who cannot understand the reasons for not setting the hay alight.

Compensation for feelings of inferiority is seen in the case of a boy who stole individually nearly 150 keys from house doors and kept a diary with

the place and date of each theft. Sexual crimes of this type are exemplified by a man who exposed himself to women about his mother's age as he, unconsciously, wished to prove he was a fully developed man.

Although many sexual offences can be satisfactorily explained by psycho-analysis, some appear to rest on a more superficial basis. For instance, a boy stole female underclothes from clothes lines to obtain stimulation for masturbation. In another case, a man exposed himself to three strange girls immediately after thinking of coitus with a girl with whom he was greatly in love.

Sexual causes are frequently the origins of criminal acts which apparently have no relation to sex. An instance is that of a man who had lived happily for two years sharing a house with another man, a homosexual. Owing to obtaining a knowledge of the law, he decided to move. Two days after he had transferred his furniture from the house he committed suicide.

Another cause of delinquency is promise of a reward by some more intelligent person. A defective walked into a garden strange to him and openly cut evergreens for selling as he had been told by a companion that he had permission to do so.

*Summary.*—The nature of the uncertified chronic types has been investigated in 6 groups of cases from two towns. In a total of 250 patients, 31 different diagnoses were made. Of these, anxiety, depression, schizophrenia and confusion were the most frequent. The sexes were equal and the majority of the cases were aged from 20 to 59 years. Comments are made on anxiety, depression, schizophrenia, confusion, post-encephalitic conditions, sexual aberrations, mental deficiency and delinquency.

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## THE TREATMENT OF WOUND SHOCK.<sup>1</sup>

WAR MEMORANDUM NO. 1. MEDICAL RESEARCH COUNCIL.

Prepared by the Committee on Traumatic Shock and on Blood Transfusion.

*(Instructions Produced in Co-operation with the Army Medical Service.)*

### MECHANISM OF WOUND SHOCK.

THE results of injury are complex and, in dealing with the wounded, the treatment of shock must supplement the arrest of hæmorrhage, prevention of infection and repair of damaged tissue. Shock may occur with any injury but particularly with those that are accompanied by hæmorrhage and widespread tissue damage.

By *primary shock* is meant a condition of collapse which may follow soon after the receipt of injury and which is not due to hæmorrhage. The condition resembles fainting and responds to the recumbent position, warmth, relief of pain and administration of stimulants. The rest of this memorandum deals with secondary shock and primary shock will not be considered further.

*Secondary or wound shock* develops insidiously some hours after injury. It is characterized by weakness, pallor and raised pulse-rate, and in advanced cases by lowered body temperature, sweating, low blood-pressure, rapid "thready" pulse, vomiting, and intense thirst. It is to be emphasized that medical officers should train themselves to recognize wound shock in its earliest stages, for it is in these that treatment is likely to prove effective.

*Wound shock closely resembles the effects of hæmorrhage in its clinical features and is likewise a condition of circulatory failure, due to diminished blood volume, with a consequent fall in heart output and blood-flow through the tissues of the body.* External hæmorrhage, and loss of blood and blood plasma into the tissues, account for the decrease in blood-volume in wound shock. Whereas hæmorrhage is a relatively simple disturbance, shock is known to be a state resulting from many factors in addition to blood loss, fatigue, dehydration, pain and exposure to cold and wet may in individual cases all contribute to its origin. If shock is to be successfully prevented or treated, these contributory factors all demand attention, and, in some instances, no further measures are required. In the majority of cases, however, active steps must be taken to restore blood volume.

Some figures from the war of 1914-18 will indicate the relationship between the clinical condition and blood volume. The cases of shock were divided into three groups. Group I comprised patients whose clinical condition was good; pulse-rate between 90 and 110, systolic pressure above

<sup>1</sup> Reprinted by permission of the Medical Research Council and the Controller of H.M. Stationery Office.



95 mm. Hg and blood volume over 75 per cent of normal. In Group II the general condition was serious; pulse-rate 120 to 140, systolic pressure 70–90 mm. Hg and blood volume between 65 and 75 per cent of normal. In Group III the patient was dangerously ill; pulse-rate 120 to 160, systolic pressure 60 mm. Hg or less, and the blood volume between 50 and 65 per cent of normal. These findings, which are in essential agreement with others obtained at the same time and subsequently, show that a reduction of the blood volume by 25 per cent produces only slight symptomatic disturbance in the patient, whereas a further reduction of 25 per cent produces a condition so serious that recovery is rare.

The lesson of these figures is clear. If measures to restore the blood volume are to prove effective, every effort should be made to apply them early, before the blood pressure has fallen below 90 mm. Hg or the pulse-rate has risen above 120. Moreover, the amount of blood, plasma, or serum transfused should be large enough to overcome the deficit; at least 2 pints of blood are required in mild cases, and 4 pints of blood in severe cases<sup>1</sup>, for the normal blood volume is about 9 pints. To delay transfusion until signs of advanced shock have appeared is to wait until irreversible damage has occurred to blood-vessels and central nervous system and no permanent restoration of the circulation can be achieved.

Observers during the war of 1914–1918, as well as experimental investigators since, have found that a constant feature of shock is *reduction of blood volume*. All the distressing and dangerous symptoms as well as the progressive deterioration in general condition, which is characteristic of shock and which, unless arrested, terminates fatally because of circulatory failure, can be largely explained by this one feature. Treatment of shock based on this hypothesis is eminently successful.

#### *General Effect of Reduction in Blood Volume.*

Reduction in blood volume causes a general vasoconstriction which attempts to maintain the blood-pressure at a normal level. The vasoconstriction may be completely effective for a volume loss of approximately two pints (1136 c.c.) but when the loss is greater the blood-pressure cannot be maintained and the systolic pressure may, in extreme cases, fall even lower than 50 mm. Hg. Thus, when reduction in blood volume is large and the cardiac output is poor, both the vasoconstriction and the lowered blood-pressure cause diminution in the tissue circulation, and, if inadequate tissue circulation is too long continued, the oxygen lack causes irreparable damage. One manifestation of this permanent damage is an increase in capillary permeability so that generalized capillary leakage, including pulmonary œdema, occurs. Consequently, when blood is introduced into the circulation, the plasma cannot be retained. Then, the patient is unable to recover even if his blood volume be fully restored with blood itself.

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<sup>1</sup> In practice, it may be found that the same volume of citrate plasma or a smaller volume of serum may be equally effective.

*Conditions of the Circulation in Shock.*

In theory, the condition of the circulation depends upon whether the reduction in blood volume is due to hæmorrhage or to plasma loss. Both causes operate in almost every case of war injury.

(a) *Simple Hæmorrhage.*—With simple acute hæmorrhage all elements of the blood are lost. Until the physiological compensatory mechanism begins to come into action, the blood-count shows no significant change and gives no indication of the amount of blood lost. The compensatory mechanism is an absorption of tissue fluid which restores the blood volume. Some evidence of compensatory blood dilution may be detected within an hour. The process, however, may not be complete for a considerable time. The mechanism is inefficient and slow if the tissues are depleted of fluid, dehydrated subjects (and wounded men are usually in this state) having but little tissue fluid to yield up for the purpose. Most wounded men tolerate hæmorrhage badly, and the need to restore blood volume is correspondingly urgent.

(b) *Plasma Loss.*—Diminution in blood volume caused by plasma loss is more dangerous than the same reduction due to hæmorrhage. Loss of plasma results in a concentration of the cellular elements of the blood which increases the viscosity. The increased viscosity of the blood causes a reduction in tissue circulation over and above that produced by vasoconstriction and fall of blood pressure, and so still further embarrasses the circulation. Under these conditions the patient suffers from oxygen lack.

(c) *Combined Hæmorrhage and Plasma Loss.*—Theoretically, blood dilution or blood concentration should arise according as to whether simple hæmorrhage or plasma loss is the more marked feature; dilution might, indeed, balance concentration, so that, apart from a determination of blood volume, there would be no apparent gross changes in the composition of the blood. From the practical aspect and with the wounds of war, the usual dehydration of a wounded man tends to inhibit compensatory blood dilution for hæmorrhage, while the amount of tissue injury encourages plasma loss.

CLINICAL RECOGNITION OF WOUND SHOCK.

The recognition of shock in its advanced stages presents no difficulties. As previously pointed out, the condition is characterized by weakness, pallor, raised pulse-rate, low body temperature, sweating, low blood-pressure, rapid "thready" pulse, vomiting, and intense thirst; the lips, ears and nails may be cyanosed and the tongue dry; consciousness may be impaired but it is important to realize that many even moribund patients are mentally alert.

Recognition of shock in the earlier stages is by no means easy. Difficulties arise because pallor and increased pulse-rate, which are the only constant manifestations of early shock, are not confined to this condition. Shock should be suspected in every case where injury has been extensive, where much blood has been lost and exposure very prolonged, and where

the skin is pale and cold and the pulse over 100. These cases should be watched carefully. Some improve, the colour of the skin becomes more normal and the pulse-rate slows. In others definite signs of shock develop. Indications that shock is developing or progressing are a rising pulse-rate, a decrease in pulse pressure (difference between systolic and diastolic values), increasing pallor and the onset of sweating. In the later stages of shock the systolic blood-pressure may fall to 50 mm. Hg or less.

If signs of shock are present, particularly pallor and a pulse-rate above 110, treatment should be instituted without delay, even though the systolic blood-pressure is over 100 mm. Hg. If the blood-pressure is over 100 mm. Hg, the condition is partially compensated but the arterial pressure is being maintained only by intense vasoconstriction and is liable to fall rapidly with the slightest intensification of the shock, as for example, from anaesthesia or a small loss of blood or plasma.

#### TREATMENT.

##### *General Principles.*

Ideally, the treatment of shock "should begin before its onset," for he who awaits the fully developed clinical picture with marked circulatory disturbance and the blood-pressure at a dangerously low level, will seldom treat a case successfully. The good clinician will recognize not only the definitely established condition but also the prodromal features which may be expected to precede shock or which may mask symptoms and signs. In every case an estimate should be made as soon as possible as to how many of the factors which contribute to shock are operating. The various measures required should then be instituted promptly in an order appropriate for the patient. *It is now generally accepted that the most important single requirement for arresting the progressive deterioration in general condition which is such a feature of shock, is restoration of blood volume and thereby of tissue metabolism.* It cannot be emphasized too often that success depends mainly upon the promptness with which this restoration can be made. Restoration of blood volume should precede operative measures in all cases except those in which the nature of the injury brooks no surgical delay.

##### *Treatment before reaching Military Casualty Clearing Station or Civilian Casualty Receiving Hospital.*

The treatment that can be given in the advanced medical units, Regimental Aid Posts, Advanced and Main Dressing Stations, Field Ambulances, or at civilian First Aid Posts, is dependent upon military operations or enemy action at the time. During quiescent periods it should be possible to transfuse casualties in the Fighting Services with plasma at an Advanced Dressing Station, while at the Main Dressing Station it should be possible to form a Resuscitation Centre and to undertake some of the details of treatment, including administration of oxygen.

*Control of Hæmorrhage.*—During active operations the most that can be done in very advanced positions is to limit hæmorrhage and plasma loss efficiently, with either a firm bandage or tourniquet and to contrive some comfortable form of splint in order to prevent the pain and local plasma loss caused by movement of a fractured limb during transport. When a limb is so mangled that there is obviously no chance of repair, a tourniquet should be applied close to the upper level of the wound in order to cut off the whole blood supply to the wounded area and so prevent not only loss of blood but also loss of plasma into the injured tissue.

*Protection from Cold.*—The wounded must be protected from cold. Stretcher-bearers should be familiar with the proper use of waterproof sheets and blankets as described in R.A.M.C. Training Manual (1935), Sections 74 and 75. When blankets are not available, protective clothing should be placed between the canvas of the stretcher and the patient, rather than on top of the patient. While the patient is awaiting evacuation the foot end of the stretcher should be raised.

*Administration of Water.*—It is of great importance to administer water freely and repeatedly to all wounded except those who are unconscious or who have abdominal wounds. It is an advantage if the water contains half a teaspoonful of salt to the pint. Warm drinks such as sweetened tea should be used when possible.

*Blood Transfusion.*—The Army transfusion apparatus allows of blood or plasma being administered at least as far forward as Main Dressing Stations. The further forward that this life-saving treatment can be given, the greater the chance of success.

*Morphine.*—All casualties who have had morphine administered should have the amount and time of administration written on their foreheads or recorded on a label attached to them, in order that they may not be overdosed on arriving at the C.C.S. or Casualty Receiving Hospital.

*Chest Wounds.*—Open wounds of the chest, unless quickly closed, cause a high mortality. Medical officers in forward areas should therefore be prepared to close such wounds immediately, even though nothing more than skin sutures be used.

*Treatment at Military Casualty Clearing Station or Civilian Casualty Receiving Hospital.*

A patient admitted to a C.C.S. or Casualty Receiving Hospital, who is judged by the medical officer in the *Receiving Room* to be unfit for immediate operation by reason of shock, should be admitted to a special Resuscitation Ward where the essential rest and quiet, so impossible to obtain in a busy general surgical ward, can be ensured, and where other measures designed to restore the circulation can be quietly carried out.

As soon as the patient is admitted to the *Resuscitation Ward* the medical officer should decide as to the urgency of operation. The more pressing cases should remain on stretchers, in order to avoid undue disturbance

before removal to the operating theatre ; less severe cases should be put into a warm bed in the ordinary manner. All beds and stretchers should be slanted head downwards by raising the foot nine inches.

As a general rule, no attempt is made in a Resuscitation Ward to carry out local treatment to the injury except for obvious requirements such as the arrest of free hæmorrhage or the adjustment of a splint on a painful improperly immobilized limb. Apart from such simple procedures, treatment for collapse and shock as detailed below must always take precedence over reparative surgery. There must be occasional exceptions to this rule, as when, through delay, infection is well developed, or when, because of the site of wounding, no delay in local treatment is admissible. In such cases simultaneous general and local treatment will offer the only chance of success.

In a Resuscitation Ward the following features which cause or contribute to shock need to be considered and dealt with :—(1) FATIGUE, (2) COLD, (3) PAIN AND RESTLESSNESS, (4) HÆMORRHAGE AND PLASMA LOSS, (5) REDUCTION OF BLOOD VOLUME, (6) DEHYDRATION, (7) OXYGEN LACK, (8) INFECTION, (9) SPECIAL INJURIES.

*Treatment of Fatigue and Cold.*—At a C.C.S. or Casualty Receiving Hospital efficient arrangements to combat fatigue and cold should be available. Wounded men become exhausted from pain, lack of sleep, fear, and prolonged exertions previous to wounding. Shocked patients, therefore, require complete rest at the earliest opportunity, under conditions of quiet and shelter. Wet and dirty clothes must be cut off with as little disturbance as possible. The patient should be clothed in warm pyjamas and placed in a bed warmed by hot-water bottles, or by hot bricks wrapped in blankets or by more elaborate apparatus, such as an electric blanket, a radiant heat bath, or a shock cage. Arrangements must be made for the warming of stretcher cases while they are awaiting attention.

*Relief of Pain and Restlessness.*—Morphine : For the relief of pain, which is of the first importance, morphine is of great and exceptional value ; it is also useful to allay undue restlessness. It can be given by mouth, or by subcutaneous, intramuscular or intravenous injection. Usually it is given subcutaneously or intramuscularly in a dose of  $\frac{1}{4}$  to  $\frac{1}{2}$  grain of a salt (e.g. hydrochloride or tartrate) of morphine. It may be given orally (either allowed to dissolve under the tongue or swallowed) in similar doses, but the analgesic effect then takes longer to develop. When the circulation is very feeble, absorption from the stomach or subcutaneous tissues may be abnormally slow. An almost immediate effect of morphine can be obtained, regardless of the state of the circulation, by intravenous injection. Up to  $\frac{1}{4}$  grain may be administered intravenously ; the morphine should be diluted with sterile water to at least 1 c.c. and the solution injected slowly (the injection occupying at least one minute).

If a full dose of morphine, as above, has been given, a second dose should not be administered until at least four hours later. Excessive doses may

increase the symptoms of shock. If there are signs of serious depression of the respiratory centre due to morphine overdosage, oxygen should be administered.

*Arrest of Hæmorrhage and Plasma Loss.*—A casualty admitted to a Resuscitation Ward needs to have the site of wounding superficially examined in order to confirm that hæmorrhage has been arrested and to ascertain if a tourniquet has been used. Whether the tourniquet is removed or left in position depends very much on the extent of the injury. When a limb is so severely mangled that conservation is unlikely and the tourniquet is found to be in a satisfactory position just above the site of the injury, it must be left in position until amputation above is performed later. Removal of the tourniquet is inadvisable, because extensive plasma loss quickly occurs into the injured area, even though there is no bleeding. If removal of the tourniquet is unavoidable, arrangements for a transfusion should be made.

When a limb is not hopelessly damaged, the blood supply must not be completely occluded. Instead of a tight tourniquet, it is better to use large strong bandages bound tightly over several layers of wool, and so to apply firm diffuse pressure not only over the wound but also embracing the whole limb. Such bandaging effectively limits plasma loss. Rubber bandages are apt to cause too much ischæmia and should not be used. Plasma loss in injured tissue is greatly increased by movement. Immobilization is, therefore, of great importance.

*Restoration of Blood Volume.*—Experience during the war of 1914-18 showed that the most valuable single method of combating shock was by transfusion of blood. This restores effective blood volume and increases oxygen carrying power. The earlier the blood volume is restored, the better the prognosis. When blood volume has been so reduced that arterial pressure is significantly decreased, consistently good results cannot be expected from the transfusion of one pint (568 c.c.) which, owing to limitation in supply, was all that it was usually possible to administer to any one case at the time of the war of 1914-18. The establishment of a Blood Transfusion Service aims at allowing an ample supply of blood to be available for each case, while the apparatus issued is designed to make rapid transfusion possible under almost any conditions. From two to four, or even more, of the pint bottles supplied by the Blood Transfusion Service may be required for a single case, according to severity.

Once the symptoms of shock have been relieved by transfusion, every effort should be made to limit the loss of blood at a subsequent operation. Symptoms of shock readily recur after even a small blood loss, and a volume of blood equal to that lost may not then again restore the patient. If hæmorrhage at operation is likely to occur, a drip transfusion should be set up at the beginning of the operation, in order immediately to compensate for any blood loss.

*Substances used for Restoring Blood Volume.*—(a) Whole blood: This is of proved value for shock, irrespective of whether the symptoms are due

to loss of blood by hæmorrhage or to local plasma loss. It has already been emphasized that the average case requires a much larger amount than is commonly used.

(b) Human plasma, human serum : These substances, because of superior keeping qualities, are more convenient than whole blood for use under field conditions. In some cases, such as extensive burns, where reduction in blood volume is due entirely to plasma loss, replacement by plasma or serum is theoretically correct. Moreover, even in hæmorrhage, the restoration of blood volume, serum proteins and an adequate blood-pressure may be of greater value than increasing the oxygen carrying power of the blood : indeed, when the amount of fluid in effective circulation is increased, the efficiency of such red cells as have not been lost by hæmorrhage is automatically increased.

(c) Isotonic saline or glucose, Ringer-Locke solution, gum saline : If neither blood nor plasma nor serum is available, any of the above solutions can be given, i.e. one pint of isotonic saline together with a pint of isotonic glucose may be administered in fifteen to thirty minutes. Restoration of blood volume by the intravenous infusion of these solutions is of transient value only and is not devoid of risk (see below). Gum saline, unless very carefully prepared, has been found to be dangerous and it will not be issued for use in the field.

*Dehydration.*—Dehydration seriously contributes to shock. All wounded subjects can be assumed to be suffering from some degree of body water depletion. Since the loss of water by the body is accompanied by loss of salts, of which the most important is sodium chloride, all drinks should contain half a teaspoonful of salt to the pint. All casualties, except those who are unconscious or who are suffering from abdominal wounds, should be pressed to drink repeatedly and copiously even though there is vomiting from excess of morphine or other cause. Special orderlies or nurses should be detailed to encourage and assist patients to drink. Any delivery device which allows water to be swallowed with a minimum of effort and movement is of value. Warm sweetened tea or coffee should be given whenever possible and this, as with all drinks, should contain half a teaspoonful of salt to the pint. If necessary the rectal route may be used to supplement oral administration : warm, half normal (0.45 per cent) sodium chloride (approximately  $\frac{1}{2}$  teaspoonful per pint) is the most suitable fluid for rectal injection and should be given in amounts up to one pint.

Intravenous saline therapy in cases of shock is not without danger, and has to be employed with great care and judgment. The intravenous route should be used only when oral and rectal administration are inadequate. The danger of intravenous administration of saline or glucose saline in cases of shock, when the plasma proteins have been depleted by hæmorrhage or local plasma loss, is due to the fact that the normal amount of water cannot be retained in the circulation, on account of the reduction in plasma protein. Hence there is a risk of pulmonary œdema. The intravenous administration

of saline or glucose to a case of shock should, whenever possible, be preceded by a transfusion of whole blood or plasma. A pint of 5 per cent glucose should be given, mixed or alternated with every pint of saline. A certain amount of sodium chloride is necessary in order to retain fluid, but excess causes oedema. The rate of administration of saline or glucose should be slow. A drip infusion at the rate of 40 drops to the minute supplies a pint in four hours, and is suitable for the average case. If dehydration is severe or abnormal losses of water (especially vomiting) are occurring, the rate must be increased.

*Administration of Oxygen.*—Administration of oxygen in high concentration tends to relieve tissue anoxia and may bring about considerable improvement in a case of shock. Oxygen should be administered to all who manifest cyanosis of the lips, ears or nails. It is especially required when there is, in addition to shock, any interference with respiratory oxygen intake, such as occurs with wounds of the chest and airway, and with pulmonary oedema whether from gassing or from the grave circulatory failure found in shock itself. Furthermore, persons who have been involved in explosions in enclosed places frequently suffer from carbon monoxide poisoning, and they also require oxygen which should, in this case, contain 5 to 7 per cent of carbon dioxide to bring about deeper breathing.

To administer high concentrations of oxygen the B.L.B. inhalation apparatus or a similar apparatus should be used. For short administration a nitrous-oxide bag and mask are useful, and even a Service respirator can be adapted. Oxygen and carbon dioxide can also be administered by means of a catheter or nasal tubes.

*Infection.*—Casualties who have been unable to receive speedy treatment may arrive with infection of wounds fully developed, and with lacerated devitalised tissue already necrotic and gangrenous. In such cases the absorption of the toxic products of bacterial infection causes a lowering of the patient's vitality which aggravates shock, and this contributes to the deterioration in the general condition. Infected tissue should be promptly removed by débridement, drainage or even amputation, and chemotherapeutic and other treatment designed to limit the infection should be given. In these circumstances resuscitation prior to operation is necessarily less satisfactory than in the case of injuries where delay in operating can be safely practised.

*Special Injuries.*—Certain injuries themselves cause a reduction in blood-pressure. This aggravates any lowering due to shock itself. Injuries of this type include certain head wounds, spinal injuries which cause widespread vasomotor paralysis, and chest wounds, especially hæmopericardium and pneumothorax. The importance of immediate closure of open wounds of the thorax has already been emphasised.

*Burns.*—The principles of treatment are the same as for wound shock. Morphine is injected to relieve pain; the patient is kept warm and fluids are given by mouth. Before local treatment of the burn itself is begun, the



blood-pressure should be restored to a normal level by intravenous administration of citrated plasma, serum or whole blood.

*Anæsthesia.*—To induce anæsthesia, gas and oxygen, combined with ether if necessary, is the anæsthetic mixture of choice, provided that a skilled anæsthetist with the necessary apparatus is available ; otherwise ether alone should be used. Care must be taken to see that cyanosis is not allowed to develop. Chloroform or spinal anæsthesia should not be employed. It must be emphasised that the administration of an anæsthetic to a shocked patient requires special care.

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## HANDICRAFT FOR SOLDIERS. RELIEVING PERIOD OF CONVALESCENCE.

FROM A CORRESPONDENT.

*[We have received permission from "The Times" to reprint this article which appeared on September 20, 1940.]*

Recovery from illness is always a tedious business, and in our new Army it presents special problems. The regular soldier, like his brother in the Navy, has usually learnt to amuse himself during the long periods of idleness and boredom in the remote places that are so often his lot. For the regular forces the hospital is only another kind of solitude to be beguiled in the same way. A man may carve a paper weight for his mother, or tattoo his body with a picture of Herod's daughter; and in the Royal Air Force the making of model aeroplanes is a hobby of growing popularity. But the hobbies of the citizen soldier of our new Army are not usually those of the solitary craftsman, so that in hospital he is condemned to mental and physical inactivity. This retards and may even prevent his full recovery.

The Army Medical Service is alive to this problem. In one military hospital the experiment has been tried of making every patient, as soon as he is well enough, and even while still bedridden, practise some craft which demands not only manual but also some artistic skill. Leather work, basket-making, and poker work have been tried, and doubtless there are many other crafts that would be suitable for the first period of convalescence. The instructors are a few women of the neighbourhood who voluntarily teach the men for several hours each week. The experiment has been an unqualified success. The speed with which the men become proficient is astonishing. A recent sale of work done in the previous two months yielded more than £100, made up of small sums. The doctors are enthusiastic about the effect of the work in relieving the tedium of convalescence, and in shortening its duration. The mental outlook of the man, they say, is quickly improved by 50 per cent. Pride of craftsmanship appears, and the zest for life returns to those who have been utterly weary, miserable, and reluctant to take up the fight again.

### VOLUNTARY HELP.

This is a phase of the soldier's return to health that the lay helper can promote, and without the intervention of committees or central organizations. In all towns and villages there are now, thanks to the Women's Institute and other social welfare organizations, women experienced in teaching handicrafts suitable for sick and wounded soldiers who are not yet ready to go to the R.A.M.C. and other convalescent centres for more

strenuous mental and physical training. The military authorities are clearly anxious to enlist this voluntary help. After a small initial outlay for tools and materials the work can be made financially self-supporting.

The movement will inevitably be extended to civil hospitals after the war, when the whole question of rehabilitation of the nation's sick and injured must receive closer attention than it has had in the past. "Lack of adequate facilities for the care of convalescents," says the *Journal of the American Medical Association*, "represents one of the gravest deficiencies in the medical scene to-day."



## Editorial.

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### STUDIES IN NUTRITION.

IN March this year the Medical Research Council issued a Report on an inquiry into the diet of families in the Highlands and Islands of Scotland by Professor E. P. Cathcart and Mr. A. W. T. Murray.

The Council state that among the basic data for research on human nutrition, and for application of scientific knowledge to its practical problems, it is clearly necessary to have definite information as to the actual diet of the people. This can only be obtained by careful and laborious studies of samples of the population.

A number of surveys of this kind have been made by Cathcart and others. In 1931 a report was issued on studies at St. Andrews, and in 1932 another report on similar studies in Cardiff and Reading. In 1936 a further report was issued on an analysis of the same data from the standpoint of actual foodstuffs rather than of fundamental constitution (protein, fat, carbohydrates, minerals, and vitamins).

The studies now described relate to the Highlands, and were made in summer on a selected number of families to determine the food intake of each for the period of one week. Duplicate studies of some of the families were made in winter, partly to reveal any seasonal variations and partly as a check on the reliability of a single week's observations as an index of the diet as a whole. The evidence so obtained showed that their method was sound, although there were some differences in food consumed in summer and winter respectively. The figures obtained in these studies relate to family groups and not directly to individuals.

Cathcart writes that although much information has now been collected on the nature and composition of diets consumed by urban and semi-urban communities, little is available as to the diets of those living in purely rural areas, in many cases far removed from large shopping centres. The difficulty of obtaining such data for the Highland and Island areas of Scotland was clearly brought out in a report to the Department of Health for Scotland (1936) by the committee which inquired into Scottish Health Services. Many witnesses deplored the passing of the old staple foods of porridge, salt herring, and potatoes, and the substitution of shop bread, tinned foods, tea and sweets, and other substances purchased from traders' vans. At the request of the committee a number of doctors supplied them with diets which they regarded as typical; they thought that a firm conclusion could not be drawn from their data and recommended further investigation. The majority of the doctors practising in these areas to-day maintain that though the diets may be lacking in variety and the amount of oatmeal used has

diminished in quantity, the families are reasonably well fed. A small minority of doctors believe that owing to the dispersion of shop-made articles the dietary is on the downward grade.

Cathcart considers there is certainly a general, and it would seem a well-founded complaint, about the lack of home-grown vegetables, the diminishing consumption of fish, and the widespread winter shortage of milk.

The present dietary study in the Scottish Highlands, in which the dietaries of 56 families were investigated by the methods previously used, was made on a number of relatively isolated areas in the counties of Ross, Sutherland, and Inverness. Most of the families belonged to the crofting class, but many had subsidiary occupations as fishermen, labourers, and so on. It was impossible to obtain trustworthy information as to their economic status, and even if it had their income in terms of money would give but little information of their real economic status.

The number of people involved in the study was 349, of whom 118 were children under 12 years of age. The average family man-value on the Cathcart-Murray scale was 4.62, and the average diet man-value 4.76. The average caput value was 6.02. The use of these coefficients was explained in the Cathcart and Murray report of 1931. To express a family diet in terms of the amount consumed by an adult male, it is necessary to divide the total by a figure which is arrived at by assigning a fractional value—on a scale based on experience—to each member according to sex and age. This figure is the family man-value. The “diet man-value” is a corrected figure in which allowance is made for individual absence from meals and for entertainment of visitors. The caput value is merely the number of persons in the family and gives the consumption per head irrespective of age and sex.

The question whether the data obtained from a single week's observation of the dietary of a single household can be regarded as a reliable guide to the average diet of the family is still under discussion. In the last report of the Technical Commission on Nutrition of the Health Organization of the League of Nations it is recommended that “all inquiries be repeated three or four times during the course of the year in order that seasonal variations may be brought to light. These variations are not of equal importance in all circumstances.” Cathcart states that seasonal variation under modern conditions of urban life is most obvious in respect of vegetables, especially green vegetables, and also to a certain extent of fruits. These differences may definitely affect the quality of the diet but play an infinitesimal part on the quantity or energy side. Unfortunately the purchase of green vegetables does not form a striking item in the budget of the majority of the poorer members of the community at any time; seasonal variation is not in practice a major factor. When the income is available for the purchase of seasonal foodstuffs other than vegetables, seasonal variation may quite definitely influence the type of dietary.

That seasonal variation has only a small influence in determining the

nature of the food consumed by the less wealthy members of the community is certainly suggested by the duplicate dietary survey made in St. Andrews. There the mean values obtained for the two studies were to all intents and purposes identical. The general impression was that there was little difference in the consumption of food in winter and summer, although there were distinct differences between individual duplicated studies. The general impression given, both from the money expenditure and the type of food-stuffs purchased, was that on the whole there was little real difference in the consumption of food in winter and summer. While this conclusion may be valid for urban it might not be true for communities far removed from shopping centres, as the family has to subsist to a greater or less extent on home-grown materials and the simple staples. This point was tested by a further study of 44 families in the late autumn and winter season. There are thus duplicate data for 44 families at six months' interval. The results obtained are stated in the following table :—

TABLE I.—SUMMARY OF DIETS OF 58 HIGHLAND FAMILIES (USING THE CATHCART-MURRAY MAN-VALUE SCALE).

Family man-value = 4.62 Diet man-value = 4.76		Protein	Fat	Carbohydrate	Total Calories	Calories, less 10 per cent
Daily intake per man	..	118 g.	128 g.	587 g.	4,082	3,673
Standard deviation	..	32.8	41.3	164.8		939
Percentage of total calories	..	11.8	29.3	58.9		

Cathcart considers that the formula for calculating man-value gives a reasonably fair measure for the population in this country. Quite recently Evang and Hansen used this scale as being best suited for their study of a population in Norway very similar to our own.

The values stated in terms of the international scale, calculated on a 3,000 calorie basis, are given in Table II.

TABLE II.—COMPARISON OF CATHCART-MURRAY AND INTERNATIONAL FAMILY COEFFICIENTS.

No. of families	Diet man-value	Coefficient	Intake per man per day			
			Protein (grammes)	Fat (grammes)	Carbohydrate (grammes)	Total calories
58	4.76	C.M.	118	128	587	4,082
58	4.57	International	124	136	620	4,313

It will be noticed that 10 per cent is allowed for loss. As this could not be determined, the gross intake was reduced by the conventional figure of 10 per cent. The difficulty of determining the actual consumption was due to certain of the constituents of the household meals, particularly potatoes, which are prepared in larger amounts than are required for the household meals, and the excess is used for the feeding of fowls, etc. The actual waste of edible calories is very small and probably is quite comparable to that determined in former studies, viz. a wastage of the order 2.5 per cent and probably a reduction of 2 to 3 per cent in the cases of protein and fat would more than cover such losses as take place.

The percentage derivation of the total calories corresponds to the general

distribution found in the previous studies. There is, however, a slight increase in the calories derived from protein and a diminished percentage from fat.

So far as gross quantities are concerned the rural Highland diets were superior to the earlier urban ones. The amount of protein consumed is definitely high and the fat consumption substantial. The intake of total carbohydrate is also higher than in the previous studies.

Duplicate studies of 44 of the families are shown in the following table :—

TABLE III.

<i>Summer—</i>		Protein	Fat	Carbohydrate	Total calories	Calories less 10 per cent
Family man-value = 4.51						
Daily intake per man	..	122 g.	134 g.	587 g.	4,155	3,744
Standard deviation	..	32.6	41.3	187.6		895
Percentage of total calories	..	12.0	30.0	58		
<i>Winter—</i>						
Family man-value = 4.57						
Daily intake per man	..	118 g.	138 g.	567 g.	4,080	3,681
Standard deviation	..	30.6	38.0	124.1		744
Percentage of calories	..	11.8	31.4	56.8		

There is close agreement between the two sets of studies. While the winter protein is some 3.6 below, the fat is 2.8 above the summer intake : winter carbohydrate is about 3.5 per cent below summer intake, as is also the energy content by about 1.6 per cent. The striking agreement suggests that seasonal variation plays only a modest role in influencing the average intake of a group of families.

It might have been expected that there would have been a definite increase in food intakes in the winter period, but this is not apparent. The probable explanation is that the inclement weather and shortness of the working day caused the families to lead a less strenuous life as regards out-of-door activities with a consequent diminution of energy expenditure. At the same time heat-loss is diminished by keeping the house warmer and wearing heavier clothes.

#### MINERALS AND VITAMINS.

The intake of protein, fat, carbohydrate, and total calories may be regarded as fully adequate—are the minerals and vitamins similarly adequate ? Cathcart calculated the summer and winter intakes both per caput and per man. The results suggest, if the Sherman standards of 0.68 gramme for calcium, 1.32 grammes for phosphorus, and 0.015 gramme for iron be adopted, that both on the man and caput basis the needs of the families were on the average satisfied both in the summer and winter studies. Cathcart's figures are : *Summer, per man*, calcium 1.32, phosphorus 2.49. *Per caput*, calcium 1.04, phosphorus 1.98. *Winter, per man*, calcium 1.13, phosphorus 2.25 ; *per caput*, calcium 0.89, phosphorus 1.79. Even the lower caput value of 0.89 gramme of calcium in the winter study would allow 1.2 grammes to each child below age 12 and leave 0.7 gramme per head for the remainder of the family.

The vitamin intakes, so far as A, B<sub>1</sub> and C are concerned, were calculated from special scales drawn up by Fixsen and Roscoe, and on one which was compiled by the Rowett Research Institute, from the data for vitamins A and C prepared by Fredericia and for B<sub>1</sub> from the data of Baker and Wright. The B<sub>2</sub> and D estimates were only available on the Fixsen-Roscoe scale, and for these mean values were calculated.

The last report of the Technical Commission on Nutrition of the Health Organization of the League of Nations states that "the existing data on vitamin requirements are difficult to apply and also to establish, and all figures contained in this section of the report are to be regarded as approximate and provisional." The figures given in the report are for vitamin A 1,400-3,000 International Units, for B<sub>1</sub> 300 International Units, and for C 600 International Units (30 mg. of ascorbic acid). For vitamin D no general figure is given; the requirement depends on the amount of sunshine enjoyed, as well as on the quantities of calcium and phosphorus in the diet. Cathcart's figures in terms of International Units per day are:—

Vitamins		FREDERICIA SCALE.				FIXSEN-ROSCEE SCALE			
		Per man		Per caput		Per man		Per caput	
		Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
A ..	..	2,653	2,637	1,997	2,177	9,232	6,672		
B <sub>1</sub> ..	..	1,033	974	778	780	1,185	1,257		
C ..	..	1,179	1,378	924	1,090	2,240	2,740		
D ..	..	—	—	—	—	3,855	4,464		
B <sub>2</sub> ..	..	—	—	—	—	0.66*	0.56*		

\* Mg. of Riboflavin.

Cathcart considers the intakes of A, B<sub>1</sub> and C, are adequate.

Study of the foodstuffs used was also made and certain items may be regarded as of universal consumption. These include butter, white bread, potatoes and (curiously enough) a luxury in the form of "tea" bread. Eggs belong to the same group. Beef, ham and bacon, cheese, and root vegetables form a second group of food materials, common to about three-quarters of the families studied. It is interesting to note that, as in the case of St. Andrews, the consumption of fresh fish by the Highland families is low—even in the summer study. The consumption of leafy vegetables is also low, although that of root vegetables other than potatoes is high.

#### DIETARY STUDY IN THE ISLAND OF LEWIS.

At the suggestion of Sir Edward Mellanby, Cathcart undertook an investigation of the small group of families living in an isolated area in the Island of Lewis. The 23 families investigated were again mainly crofting families, although in most the men had other activities such as fishing. It was found that the Lewis intake of protein is slightly above and the intake of fat definitely above that of the Highland families studied. The percentage of first-class protein in the diet is also above that of the mainland. The mineral and vitamin content of the diets seem to be adequate.



All the Lewis families consumed fresh fish, fatty fish being preferred to white fish.

The inhabitants of Lewis have always been reputed to have excellent teeth, and this reputation has been sustained by the recent examination of the teeth of many of the children by King. The results of his examination are striking, as is evident from the following excerpt from Table III of his report.

Age group (years)	District	All teeth		Average caries figure
		Number	Percentage caries	
All ages up to	Lewis (rural)	23,877	14.0 $\pm$ 0.2	0.30
15 .. ..	Lewis (urban)	5,708	33.0 $\pm$ 0.6	0.76
	W. Ross-shire mainland	2,198	34.7 $\pm$ 1.0	0.83
	London	6,320	36.3 $\pm$ 0.6	0.76
	Sheffield	4,836	32.3 $\pm$ 0.7	0.76

King is of opinion that the superiority in both tooth structure and freedom from caries among the Lewis rural children is to a large extent attributable to the relatively high content of the fat-soluble vitamins and of calcium and phosphorus in their foodstuffs. He found no evidence to suggest that the consistency of the food or the carbohydrate content of the food played a part either direct or indirect, as in both the urban and rural areas of Lewis the general soft consistency of the food was reflected in the low incidence of dental attrition. Further, the condition of the gums of both the urban and rural children in Lewis was found to be rather worse than in other districts.

Cathcart's inquiries made it clear that on the average the utilization of the ordinary articles of diet other than fish, mainly herring, by the Lewis householders, is lower than that of the families on the mainland.

## Clinical and other Notes.

### A CASE OF DISLOCATION OF THE NECK.

BY MAJOR G. T. GIMLETTE,  
*Royal Army Medical Corps.*

SAPPER A. T., aged 20, was bathing on a sandy beach near Gibraltar. He waded into the water up to his knees and then dived into the trough of a wave and struck his head on the sandy bottom. He immediately felt severe pain in the neck and loss of power below. One of his comrades dragged him to the shore, where after an interval he was able to rise up to his knees, but then fell back again.

On his arrival in hospital about one hour later, the neck was rigid and painful and the head turned to the left and bent over to the right and a distinct irregularity of the cervical spines could be felt. The sternomastoid muscle was tense on the right side. This was a curious point, since the position of the head was that for a dislocation of the right articular process and the left, not the right, sternomastoid should have been tense. Further X-ray examination by stereo lateral skiagrams showed that the injury was a dislocation of the right articular process of the third cervical vertebra. The patient, however, volunteered the information that his head had always been held sideways and that he had had trouble about it when being fitted with uniform. After the reduction of the dislocation he was found to have a right-sided torticollis. Possibly this may have contributed to the ease with which the dislocation appeared to have taken place.

Examination of the nervous system showed very little wrong. He was able to pass water and move all his limbs and all reflexes were normal except for slight weakness in response of the right upper abdominal reflex. Sensation was normal. He did, however, complain of pain and weakness of the right arm. The deltoid, supraspinatus and infraspinatus muscles were most affected, but some weakness was present in all the muscles of the limb without any muscle being incapable of voluntary response.

As regards treatment, it was decided to follow Bohler's technique of strong traction with Glisson's sling and pulleys. There was no Glisson's sling in the Military Hospital but Dr. J. E. Deale, the Medical Officer in charge of the Colonial Hospital, had had one made for his own use, which he very kindly consented to lend. The next day the patient was given  $\frac{1}{4}$  grain morphia and 20 c.c. of  $\frac{1}{2}$  per cent planocaine was injected. The Glisson's sling was placed in position, well padded, and connected by ropes and two pulleys with a spring balance, registering to 60 lb. interposed to a hook in the wall. Traction of 50 lb. was then made for three minutes, no reduction took place. After a rest, traction of 60 lb. was made for three minutes,

again without effect. Finally nitrous oxide and oxygen were administered and the patient's head and neck pulled and manipulated by the surgeon's hands, again without result. It was then decided to try the effect of prolonged traction. The patient was returned to bed and the Glisson's sling was again fixed and fastened to the head of the bed, which was raised on blocks to the height of eighteen inches. This position was most uncomfortable, but after certain adjustments became bearable. Morphia was given at night and potassium bromide by day, and the patient was able to sleep at intervals.



FIG. 1.—Before reduction.

Skiagrams were taken each morning, and the patient was hung in this manner for six days. After four days, following an afternoon sleep, he woke feeling more comfortable and able to move his right arm more strongly. Great hopes were raised that reduction had taken place during sleep but these were dashed by a skiagram which showed no alteration in position whatever, though the neck appeared well stretched. After six days, the patient, who had displayed great fortitude, was becoming very exhausted and a change of policy became imperative. The blocks and slings were removed, he was given a good meal and a good rest in a comfortable position.

In the meanwhile, after referring to all the works of reference available, an excellent description of this injury and its treatment was found in "The Treatment of Fractures," Scudder (1923 edition). Quoting from this work "The treatment of these cases should be by what Dr. Walton has demonstrated and very properly called retrosternal flexion and rotation without extension. No amount of extension will unlock the dislocation. The head is bent laterally and slightly backward, that is abducted away from the side displaced. This will raise the articular process out of the notch in which it has fallen. Then rotation of the displaced articular process into position



FIG. 2.—After reduction.

will effect a reduction. This of course is best done under ether anaesthesia. It requires firm manipulation, but no very great force."

It was decided to apply this method, and the next day the patient was anaesthetized by the intratracheal method and the above described manipulation was carried out. Two small clicks were heard but X-ray showed no reduction. The surgeon's hands were then rendered sticky by the application of the adhesive substance dissolved off adhesive plaster with ether. This greatly improved grip, but a second manipulation was again unsuccessful. A third attempt was made. This time the head was first drawn strongly

and firmly backwards, then with no relaxation, flexed strongly and firmly over the left shoulder to the fullest extent, and finally with no relaxation, strongly rotated backwards in a clockwise direction. Suddenly there was a most satisfactory and loud click and a strong shock felt by the surgeon's hands, and all deformity was reduced. An X-ray then showed full reduction. The third time was lucky. A wool collar was applied round the neck, and the patient left quietly until the next day, when a plaster was applied taking in the upper chest, neck and head. The head and neck were placed in full backward extension in the plaster. This position was found to be absolutely necessary. If the head was allowed to flex at all it was found that forward angulation took place at the site of injury.

Although there is nothing original in this method of reduction it is considered worth recording owing to the comparative ease with which reduction was affected by the old method of Dr. Walton's in contrast with the failure by the more modern methods described in Bohler's "Treatment of Fractures." It is regretted that the former was not tried in the first instance.

I wish to express my thanks to Lieutenant-Colonel C. J. Blaikie, R.A.M.C., Officer Commanding Military Hospital, Gibraltar, for permission to send these notes for publication, and also to Dr. J. E. Deale, Medical Officer in charge of the Colonial Hospital for valuable assistance, and to Corporal H. J. Carpenter and Lance-Corporal D. Jobe, R.A.M.C., for the great trouble which they took over the radiography in connexion with this case.

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## A CASE OF MENINGOCOCCAL CONJUNCTIVITIS.

BY MAJOR J. A. BENNETT,  
*Royal Army Medical Corps (R.P.).*

AN N.C.O. was admitted into hospital on April 4, 1940, suffering from a purulent conjunctivitis of the left eye which had started two days previously. He gave a history of having been exposed to a smoky fire in a cook-house and stated that his eye smarted and felt irritable after this exposure: there was no history of infection.

The Medical Officer in charge of the case had a conjunctival smear examined by the Pathologist, Downe, Farnborough, who reported the presence of Gram-negative intracellular diplococci.

When first seen by me, there was a definitely purulent conjunctivitis accompanied by iritis. The condition of the eye, though purulent, was not like that due to a gonococcal infection: there was no history or evidence of such infection. In view of the laboratory finding of diplococci, the case was treated as such. Irrigations with normal saline for ten minutes were given every three hours, followed by "Crooke's argentum"; and atropine

1 per cent twice a day. Eight 0.5 gramme tablets of M & B 693 were given daily. Buller's shield was applied to the right eye.

Two days later, the Pathologist reported by telephone from Downe, Farnborough, where the original examination had been made, that the case was probably due to meningococcal infection. Sugar and agglutination tests confirmed this, and placed the meningococcus in Group 1. The D.A.D.P. came to the same conclusion independently.

The conjunctivitis quickly subsided under treatment, and after seventy-two hours, the eye condition resolved. M & B tablets were reduced to one, three times a day. He was discharged to duty after four days, with vision unimpaired.

*Comments.*—When first seen, two days after it started, the conjunctivitis did not appear virulent enough for a gonococcal infection and there was no evidence of this infection. The iritis was unusual. I could find no history of contact with a carrier of meningococci. Meningococci were not found in the nasopharynx.

The quick response to treatment by M & B was perhaps instructive as to the causal agent.

As far as I know, the case is unique and these notes may be of interest.

I am indebted to Colonel H. H. J. Fawcett, D.S.O., Commanding Officer, for permission to send these notes for publication; to J. C. Colbeck, Esq., M.B., B.S., Pathologist, Downe, Farnborough, and to Major K. E. Hughes, R.A.M.C., D.A.D.P., for their interest and investigations in the case.

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## A SUGGESTED METHOD OF OBTAINING PERSONAL PROTECTION IN THE FIELD.

BY MAJOR H. TEMKIN.

*Royal Army Medical Corps.*

IN the recent campaign in Flanders one saw a number of casualties who were suffering from wounds caused by the penetration of missiles through the back, and sustained whilst the soldier was seeking protection by lying in the prone position on his stomach. The problem arises as to whether this position is the one which offers most protection to the individual from shrapnel, falling bomb fragments or machine gun bullets from aircraft.

The following is a method of obtaining protection which I consider offers the important organs of the body more cover than is obtained from lying in the prone position.

The person lies on one side with the body well flexed. The top knee is bent well up to the abdomen. The arm which is uppermost is placed so that the upper arm lies along the side of the body. The hand is placed to give protection to the lower part of the neck whilst the lower arm and hand are

brought round to cover any exposed portion of the face and neck. The face and upper shoulder are turned somewhat towards the ground.

The advantages claimed are :—

(1) That from above there is not the whole of the back of the thorax, liver, spleen, spinal column, etc., exposed to falling fragments or bullets, but only the side of the body, and that is protected by the arm, which would be sufficient to prevent the entry to vital organs of many such missiles even when approaching with a high velocity.

(2) Effects of blast would be reduced, as only the side of the body is on the ground and mostly resting on the lower shoulder, iliac bone and lower leg. In the prone position the abdomen is in close contact with the ground.

(3) If lying in the trench the person occupies less length and, therefore, more people can be accommodated therein.

(4) As seen in the photographs the uppermost portion of the body, when in this position, is not appreciably higher than when a person adopts the prone position, and the individuals can be taught in a very few minutes to take up this position in as short a time as it takes to adopt the prone one.



The stick is placed horizontally across the highest part of the body in each case. In the photograph of the suggested new position, the right elbow should be somewhat further back and the hands should not overlap.

## A CASE OF DOUBLE INTUSSUSCEPTION OF THE SMALL GUT.

BY LIEUTENANT-COLONEL J. C. ANDERSON,  
*Royal Army Medical Corps.*

THE following case is worthy of record.

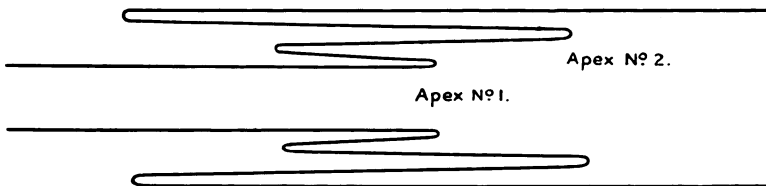
The child was a healthy plump male of 18 months. On October 31, at 8 a.m., he fell and bumped his head. After this he ate a good breakfast. At 10 a.m. he vomited copiously and a doctor was consulted. Abdominal pain was not suspected by either the child's mother or the doctor, and the vomiting was attributed to the recent head injury by both. Unfortunately, the mother was in the process of changing her residence, so the doctor advised her to seek fresh advice in her new quarters.

On November 1 a second doctor saw the child, who was vomiting inter-

mittently. Although the child cried when the bouts of vomiting came on, his mother did not realize that he was experiencing pain, and the vomiting was still attributed to the head injury. Doctor No. 2 saw the child again next day, November 2, and as he was still vomiting occasionally, he was admitted to hospital where he was kept under careful observation. The diagnosis on admission was concussion. On November 2 the bowels did not act. He passed urine twice and he vomited once at 4 p.m. The child had a restless night with little sleep, and he vomited all fluids taken by mouth. His bowels still did not act. On the morning of November 3 he was limp. There was a small constipated result from a glycerine enema. At 6 p.m. a third medical officer saw the child and ordered an enema, there was a fluid result and some small clots of blood were passed. The child was still vomiting intermittently and the vomited material was becoming offensive in character.

It was at this point that I saw this child for the first time. He was dehydrated and listless. His abdomen was not unduly distended, but two coils of gut could be seen to move with respiration in the epigastrium. No tumour could be felt. Rectal examination was negative. I suspected a volvulus of the small intestine and the right half of the colon.

At the operation, which followed the pre-operative administration of subcutaneous saline, an intussusception of the small intestine was found. It was at least  $2\frac{1}{2}$  feet above the ileo-cæcal valve and was about one foot in length. It was easily reduced and a second intussusception of the small gut was disclosed. This one was about 4 inches in length and it had lain somewhere about the middle of the first. This second intussusception was easily reduced. The bowel appeared to be viable but a yellowish patch was seen in the mesentery related to the inner intussusception. This area was crepitant and it was obvious that a small leakage of faecal material had occurred between the layers of the mesentery. When a swab was applied to the affected part a trace of faecal matter stained the gauze.



The child's condition was bad at this stage so the affected portion of bowel was anchored in the wound ; the child died four hours later.

The following points of interest are apparent :—

- (1) The symptoms were all attributed to the head injury.
- (2) The child's mother, the first and second doctors and the nursing staff did not suspect that the child was in pain.
- (3) The enteric type of intussusception together with its double character are unusual.



(4) Despite the long duration of the intussusception the bowel was viable, apart from a tiny leakage.

In view of the viability of the bowel a longer time might have been spent in getting the child into better condition for operation. I have experienced this before. A baby with a three-day-old intussusception proved at operation to have viable gut but the child died soon after the operation as a result of shock. I believe that when we are called upon to deal with a late case of intussusception we are justified in delaying operation until the child's general condition has improved by warmth and the administration of fluid. If the bowel is gangrenous the child has little chance of recovery ; if the bowel is viable hasty action may endanger the child's chances of recovery from the operation.

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### DESCRIPTION OF THE "SLING SEAT."

BY LIEUTENANT-COLONEL (QUARTERMASTER) D. M. MURPHY, V.D.,

*Late of the Royal Canadian Army Medical Corps.*

REALIZING the great need for a form of stretcher more suitable for certain wounded cases, also appreciating, through personal experience, the very tiring and often difficult task of carrying wounded by hand seats I have designed this new device for use in the proper circumstances (sitting cases).

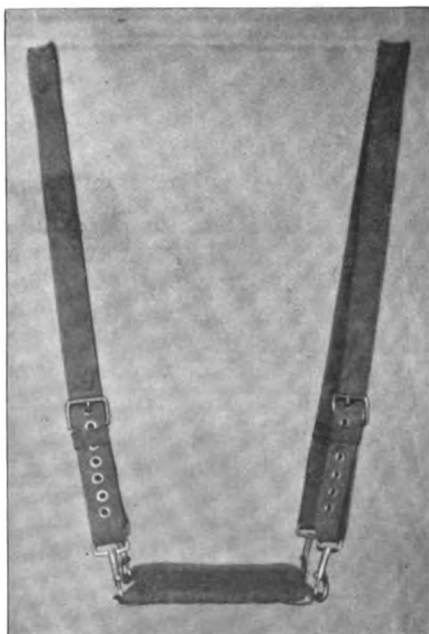


FIG. 1.—The "Sling Seat."

I have called this device a "Sling Seat," as it consists of a small padded seat, size about 10 by 12 inches, suspended by two strong web slings, the latter fitted with buckles to allow adjustment of the length of the slings. These web slings fit over the shoulders of two bearers and when ready for use appear as a small seat suspended between the two bearers. The foundation of the small seat is made of a wire frame filled in with a grille of smaller wire, one inch spaces. All is then padded and covered with heavy duck. Four loops are provided in the frame to attach the ends of the slings which are equipped with snap hooks.

*Position No. 1* is described as follows: The two bearers will face and walk in the same direction. The wounded man will be placed on the seat



FIG. 2.—Position No. 1, loaded.

between them and will recline slightly backward, being supported by the crossed arms of the bearers. This position permits both bearers to see the ground in front of them and avoid stumbling.

*Position No. 2.*—This might be termed the "Trench Position." The wounded man will be placed astride the seat, as on a saddle, and the bearers, with the slings over their shoulders, will turn as in file. The front bearer will grasp and support the wounded man's legs during carriage, while the rear bearer will steady and support the body. In this position a squad can negotiate a trench, get around traverses or climb stairs without difficulty.

*Position No. 3.*—This is the method by which a wounded man can be carried in a horizontal position, by loading as for No. 1 position; the bearers will then support the head, shoulders and legs, with their outstretched arms. A large proportion of the weight will be taken by the small seat.

May I here point out some of the advantages of the “Sling Seat” :

The small size and weight makes it easily carried by the bearers and it requires little space in other forms of transportation.

In trench work it can be carried around traverses without exposing the wounded man.



FIG. 3.—Position No. 2, loaded.

In field work both bearers can walk straight to their front instead of moving by side steps as is the case when using handseats.

This device is especially suitable for carrying patients, if they may sit up, up or down stairs in military hospitals.

Suggestions for training personnel in the use of this “Sling Seat,” the method of loading and unloading, etc., will be gladly furnished if required.

To contribute anything towards the splendid efficiency of the Royal Army Medical Corps is an honour that has long appealed to me and for this reason I make this feeble effort.

## NOTES ON A CASE OF TETANUS.

BY MAJOR P. F. PALMER,  
*Royal Army Medical Corps.*

THE patient was a Warrant Officer, A. E. C., aged 31, service in India two and a half years. His history is as follows :—

February 8, 1937 : The patient was operated on for internal hæmorrhoids. The operation was performed under  $2\frac{1}{2}$  per cent novocain and the hæmorrhoids were tied with silk.

February 19 : The patient complained of stiffness of the jaws and neck ; temperature  $98^{\circ}$  F., pulse 74. The same evening he became nervous ; temperature  $98.6^{\circ}$  F., pulse 70.

February 20 : As Orderly Medical Officer I was asked to see the case in the evening. He was perspiring and extremely nervous. Trismus of the jaws was present. There was generalized muscular rigidity, and at times mild muscular spasms ; swallowing was somewhat difficult. Patient was immediately given a general anæsthetic and anti-tetanus serum was given by all routes, intrathecally 34,000, intravenously 100,000, intramuscularly 75,000. Potassium bromide grains 20, chloral hydrate grains 20 in glucose were ordered *per rectum* two-hourly.

February 21 : Disease now well marked. Slight arching of the back and drawing up of the legs, lasting half a minute. Bladder was catheterized, 22 ounces drawn off in the morning, and a similar amount in the evening. A further general anæsthetic was given and anti-tetanus serum was administered as follows :—Intrathecally 25,000, intravenously 66,000, intramuscularly 80,000. Sedative treatment was continued throughout.

February 22 : Extremely restless ; pulse 120 to 130—irregular at times. The patient fully conscious and rational ; abdomen board-like ; rectal wash-out was given followed by fluids per rectum in small amounts ; muscular spasms increasing ; patient able to take a few sips of fluid by mouth. General anæsthetic repeated and 35,000 units given intrathecally, 15,000 intramuscularly. Temperature during the day  $100^{\circ}$  to  $101^{\circ}$ .

February 23 : Temperature  $99^{\circ}$  all day ; patient a little better ; speaks with difficulty ; spasms about the same ; now complains of severe aching of all muscles. Further serum given : intrathecally 15,000, intramuscularly 45,000.

February 24 : Definite improvement ; able to take fluids by mouth and to pass urine ; spasms less frequent ; slept for long periods.

February 25 : Temperature normal, pulse 100 to 110. Has begun drenching sweats ; spasms somewhat less ; serum 21,000 units given intramuscularly.

February 26 : Frequent drenching sweats ; muscular wasting quite marked ; able to talk fairly well, but talking is liable to bring on spasms.

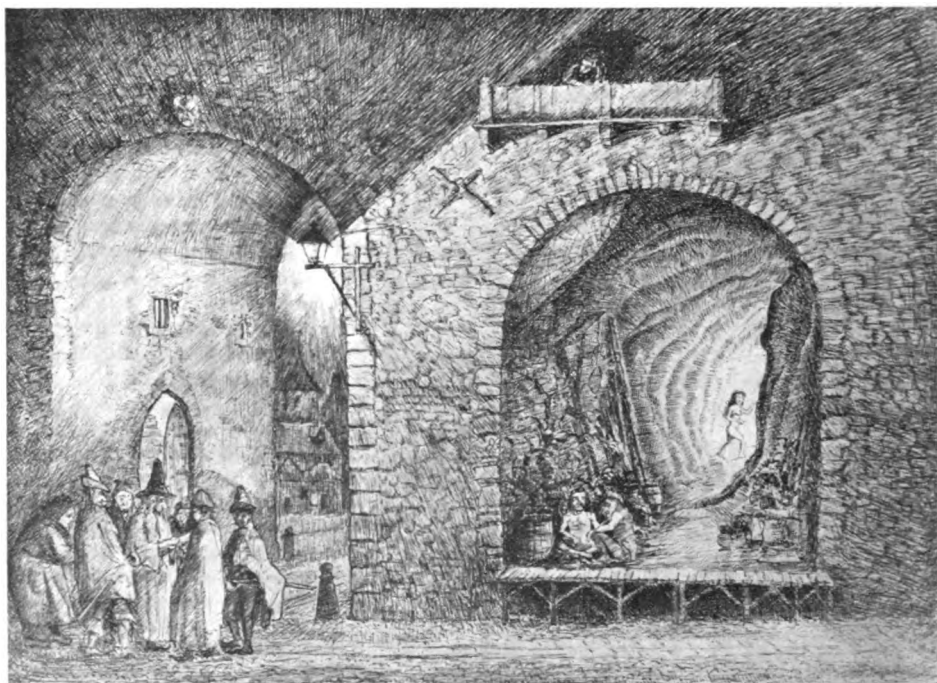
February 27 : Sweating continued ; beginning to have restless nights ; feels wide awake and worried by vivid dreams.

March 4 : Good natural sleep ; still rigid ; no natural action of the bowels as yet ; able to recline in a long chair and take some soft food.

March 15 : Now greatly improved. Abdomen and limbs still somewhat rigid ; bowels now move naturally with a little liquid paraffin. Able to have a bath ; muscle bulk increasing. Patient has tried to read but notices that his accommodation is a little slow.

March 29 : Patient is now quite convalescent. Still feels a bit jumpy and is inclined to worry ; able to get about slowly but all movements stiff.

April 7 : Up and about all day ; back a little stiff. Patient has made a " pen and ink " drawing of one of his most vivid dreams. He says that



this dream frequently occurred and has remained perfectly clear in his memory. He explained the sketch as follows :—

The scene is set in an old town. On the left is a group of armed men in medieval costume who are conspirators, talking to an old woman. Watching them from above is a one-eyed gargoyle. On the right of the picture is a cave showing a hunchback in medieval costume, talking to a fakir squatting cross-legged in the cave. In the cave are to be seen empty barrels and a gibbett with a hangman's noose lying against the wall. Moving across the back of the cave is a naked woman. About this part of the picture he is not quite clear and can only remember the figures and the fittings of the cave.

Another and oft recurring dream was that of a fruit stall filled with gaily coloured fruits.

## ÆTIOLOGY.

The disease began eleven days after a surgical procedure, and it is fair to assume infection took place at that time. There were no localizing symptoms pointing to the site of infection. The march of the disease was classical.

There are three possible sources of infection to be considered. Firstly, that infection took place from infected ligatures. This is most unlikely since ligatures were silk and not catgut. Bacteriological investigation was negative and no associated cases have occurred. Secondly, that the novocain solution was at fault. Here again bacteriological examination was likewise negative. Thirdly, that the patient harboured tetanus bacilli in his own gut, which in man can occasionally occur and is more likely to be so in a dust-laden tropical country where tetanus is fairly common amongst the indigenous population. This appears to be the most probable cause. The reason that the bacillus was not cultured in the stools may have been due to the fact that potassium permanganate wash-outs were used throughout. The dosage of serum may appear odd. The serum was given as it became available, and too, the concentration of the serum varied greatly, and dosage depended on bulk, so that no constant dose could be given.

## CONCLUSION.

- (1) A case of tetanus is described eleven days after an operation on the rectum.
- (2) Infection was probably autogenous in nature.
- (3) 511,000 units of serum were given by all routes during the first eight days of the disease.
- (4) A pen-and-ink sketch of an oft-recurring vivid dream is shown.

Permission has been kindly granted by Lieutenant-Colonel E. P. Allman Smith, Commanding British Military Hospital, Mhow, to send these notes for publication.

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## Current Literature.

### **Immunization against Rickettsial Infections. *Lancet*, August, 1940.**

The question of immunization against rickettsial infections has recently been reviewed. The best immunity is conferred by the injection of living rickettsias, but in most instances this is too dangerous a proceeding. It has been carried out among the indigenous populations of Morocco and Tunis, living murine rickettsias having been employed, while few reactions have been reported. In Europeans reactions are apt to be severe, and they differ in no way from ordinary murine typhus, which though less fatal than exanthematous typhus produces a severe infection with slow convalescence. There is no evidence that people inoculated with living typhus rickettsias become chronic carriers.

If killed exanthematous rickettsias are used the difficulty is to obtain rickettsias in sufficient quantity. In America, in order to obtain large numbers, Cox has injected rickettsias into the yolk sac of the developing embryo, while Zensser and his colleagues have employed chick embryo tissue mixed with rickettsias and spread on agar slopes. Vaccine prepared by this technique has been used on the small scale in China.

A different method has been devised by Durand and Giroud as a result of finding that a virulent pneumonia can be produced in white mice by intranasal installation of the rickettsias of exanthematous typhus. An almost pure suspension of rickettsias can thus be obtained, which after treatment with formol can be used as a vaccine. A number of people have now been successfully inoculated by this method, which is devoid of reaction, its only inconvenience being that four or five injections are necessary at intervals of five or six days. Durand and Giroud have employed similar methods for producing a vaccine against Rocky Mountain spotted fever. In South Africa Finlayson has introduced a method of precipitating suspensions of murine rickettsias with alum, thus providing a vaccine for which good results are claimed in animals. Although the relative merits of these various vaccines require further study, it is evident that in case of necessity vaccination against typhus could be carried out on a large scale.

**THEWLISS, J.** *The Structure of Teeth as Shown by X-ray Examination.* *Medical Research Council. Special Report Series No. 238.* 1940.

X-ray and chemical analysis show that enamel consists largely of hydroxy-apatite,  $\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$ . Magnesium and carbon dioxide are also found to be present, and it is suggested that the former replaces some of the hydroxy-apatite calcium and that the latter exists as simple carbonate.

The hydroxy-apatite is present in the form of submicroscopic crystallites, of which the average size is about  $0.3 \mu$ . Each enamel prism therefore contains a multitude of crystallites and these in human enamel may be divided into two groups, so arranged that their axes tend to make angles of approximately  $5^\circ$  and  $40^\circ$  respectively with the prism direction pointing to that side of the prism remote from the top of the nearest cusp.

The two differently orientated groups of hydroxy-apatite crystallites occur not only in individual prisms but in the interprismatic substance. X-ray and optical examination indicate that the  $5^\circ$  group usually predominates in the prism and the  $40^\circ$  group in the interprismatic substance. Visual inspection of radiographs of tooth sections has shown that enamel areas which are pigmented, or have taken up stain, tend to possess a low degree of calcification, and by microphotometric examination it is seen that there is a steady increase in the degree of calcification from the amelodentinal junction onwards, which culminates in some cases in a hypercalcified layer. This gradient of calcification accounts for the difference in hardness and specific gravity between the inner and outer enamel.

The inorganic material of the dentine, like that of the enamel, consists

mainly of submicroscopic crystallites of hydroxy-apatite. The average size of the crystallites is about one-tenth of that in the enamel.

Radiographic examination shows that a thin layer of dentine along the amelo-dentinal junction has a relatively low degree of calcification.

The pulp chamber is almost surrounded by a thin shell of dentine which has a low degree of calcification. Secondary dentine appears on the whole to be calcified to the same extent as the neighbouring primary dentine. Translucent root dentine often shows average calcification, but areas of high and low calcification occur.

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### Reviews.

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OFFICIAL HISTORY OF THE AUSTRALIAN ARMY MEDICAL SERVICES IN THE WAR OF 1914-1918. Vol. II. The Western Front. By Colonel A. G. Butler, D.S.O., V.D., B.A., M.B., Ch.B.Camb. Canberra : Australian War Memorial, 1940. Pp. xvi + 1,010. Price 21s.

The second volume of the Official History of the Australian Army Medical Services, 1914-1918, deals with the services on the Western Front from 1916 to 1918. The first volume covered Gallipoli, Palestine, and New Guinea, and the final volume still in course of completion is concerned with the special services, chemical warfare, problems of repair and restitution and statistics.

The volume under review while keeping the general aspect of the progress of events before us, paints the particular picture of the work of the Australian Medical Services in remarkably clear and interesting detail.

It draws also from the experiences of those services many useful lessons which should be of assistance in the present arduous times through which the medical services of the Army are passing.

The first section of the volume is concerned with the warfare of 1915, 1916 and 1917, and describes with much interesting detail the work and experiences of the Australian Army Medical Corps in a campaign waged on new and untraditional lines.

We are told of the changes in organization and method of the medical services involved by the transfer of the Australian infantry to the western front and a brief survey is given of the military conditions in the British Expeditionary Force in 1916.

The course of the fighting up to the battles of Cambrai is very well described and finally the reorganization of the Australian forces into one corps is dealt with.

In the second section of the book consideration is given to the fully developed medical service as seen at the end of that phase of the war already described, and which had reached its conclusion at the military *dies non* of the winter of 1917-1918.

As the author says, the medical services had by this time become a complete and highly developed system of social service—its duties performed by a military department which in the weight of its authority, the extent of its activities and its efficiency for the purpose in hand, could not be



exceeded and perhaps not equalled by any of the organized medical arrangements of civil life.

These services are well reviewed in the chapters of this section and we are provided with a great deal of information in regard to them of absorbing interest. Evacuation methods within the Army zone and outside it, the general surgery of wounds and preventive medicine and other matters of importance, all receive their due meed of attention and are most adequately treated.

In the third section, the story of the experiences of the Australian Army Medical Services on the Western Front is taken up afresh. At the end of 1917 it was clear that the war had entered upon a new phase and that rapid change and movement would not take the place of siege. Detailed consideration is given to the consequent fundamental changes in the nature of the problems of the medical services in general and their actual denouement in March, April and May of 1918. We are also told of the part played by the Australian Army Medical Service in the events of the two great German thrusts on the Somme and the Lys.

Readjustments necessary in the medical services as a result of these offensives are described, and in the later part of this section an excellent account is given of the work done by the Australian Medical Services during the advance up the Somme to the Hindenberg line. In the last three chapters we are taken to the end of the war and finally are told something of the interesting and important problem of combining the administration of two varying national forces—the Australian and American—and the preliminary steps in the repatriation of the Australian Imperial Force on the Western Front.

The final chapter deals most efficiently with the medical direction of the A.I.F. in general and in particular pays a well-earned tribute to the great work done by Surgeon-General N. R. Howse, V.C., Director of Medical Services of the A.I.F., who presented that ideal combination of great professional and administrative ability with other qualities of military significance which made him the great administrator he was.

It is impossible to speak too highly of this volume of the Official History of the Australian Army Medical Services in the war of 1914-1918 and the author is to be congratulated on the excellent way in which he has set out the material available to him.

In reading the book interest never flags and the reader feels at the end of his perusal of the volume that he has been presented in a readable and pleasant manner with a great deal of information of real and practical value.

The book is worthy of study by all interested in the medical problems of the Army and by many others as well, and is most confidently recommended to all officers of the military medical services as meriting their careful attention.

*Note.*—The copy of the above book received for review was very kindly sent by the Acting Director of the Australian War Memorial, Canberra.

A. E. R.

**BLOOD GROUPS AND BLOOD TRANSFUSION.** By Alexander S. Wiener, A.B., M.D. Second Edition. London: Baillière, Tindall and Cox. 1939. Pp. xvii + 306; 52 illustrations. Price 27s. 6d.

Since fresh knowledge regarding blood groups and blood transfusion is being so rapidly acquired, it is not surprising that Dr. Wiener should find it necessary to publish a second edition of his book. Indeed, in recent years so much literature has appeared that, in this edition, the author has not found it possible to make reference to all reports but has made an endeavour to draw attention only to all significant publications.

This book deals with the subject in a comprehensive way, and consequently it is not possible in the space at the disposal of the reviewer to consider all the headings under which the author treats his subject, but it may be helpful to those who are seeking a book containing detailed information if mention is made of the general layout and the scope of the work.

The first half of the book is concerned mainly with a discussion of the blood groups, selection of donors and the results of blood transfusion. It also deals with the technique of blood transfusions and the reactions that may follow their administration. Plasma transfusion which is now being carried out in the Army and blood substitutes are not discussed.

The second half of the book is confined to that aspect of the subject which deals with some of the fundamental principles of genetics and biometrics. In addition, the agglutinogens M and N with a useful chapter describing the technique of the preparation of immune sera and suitable methods for M-N tests are fully discussed. Anthropological investigations on the blood groups are also considered and the medico-legal application of blood tests is presented in great detail.

This is a book which will be found of value to those who wish to have a comprehensive survey of the fundamental facts concerning this ever-developing subject.

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## Correspondence.

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### DERMATOLOGY IN WAR TIME.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—Most people will agree with what Colonel Ingram says in his admirable article entitled "Dermatology in War Time" (*R.A.M.C. JOURNAL*, August 1940). There is, however, one point which I should like to criticize; the dosage of Sulphapyridine recommended appears to be below the optimum. Many partially treated cases of gonorrhœa returning from France proved very resistant to further treatment and this was considered to be due to inadequate dosage. At home, I have recommended five grams the first day, four the second and three a day for the next few days; intensive

dosage in the early stages seems to give the best results and under optimum conditions 19–20 grams given in the first three days have given the highest percentage of cures. In general a high dosage over a short period appears more effective than a moderate dosage over a longer period.

I am, etc.,

*The War Office,  
London, S.W.1.  
September 12, 1940.*

T. E. OSMOND,  
*Lieutenant-Colonel,  
Royal Army Medical Corps.*

### GAS CLEANSING CENTRES, FIRST AID POSTS, AND THEIR COUNTERPART IN THE FIELD.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—Captain W. A. Robinson in his article on the above subject in the August issue of the JOURNAL states that "it is obvious that it is not possible to establish buildings" for Gas Cleansing Centres in the forward areas and that "the principles involved in the centres can be applied in the field" by marking out separate areas on the ground.

When discussing First Aid Posts, however, Captain W. A. Robinson omits to mention that the use of buildings will frequently be impossible for this purpose and that the principle of marking out "a dirty" area on the ground for the reception of contaminated wounded applies in the same way.

It is further stated that "By cleansing a casualty at this Post he will be saved from the effects of Blister Gas *if he is treated early*. Even if ten or fifteen minutes have elapsed, the effects will be reduced."

It is obvious that only in rare cases will it be possible for a casualty to reach a First Aid Post in such a short time as ten to fifteen minutes and attention is therefore drawn to "Protection against Gas and Air Raids, 1939," Pamphlet No. 1, Section 106, para. 3 which states that "If the situation permits and life will not be endangered by the delay, decontamination of wounded men should be carried out in the area in which they are found." All contaminated clothing should be removed and the patient treated with Ointment, Anti-Gas.

The importance of stressing this point during training cannot be too strongly emphasized.

In order that patients who have been undressed may be reclothed, one suit of pyjamas should be carried with each stretcher in addition to the blankets.

*September 2, 1940.*

I am, etc.,

J. H. C. WALKER,  
*Lieutenant-Colonel, R.A.M.C.,  
Training Officer, Anti-Gas,  
Royal Army Medical Corps.*

## INCORPORATED SOLDIERS' &amp; SAILORS' HELP SOCIETY.

## LORD ROBERTS MEMORIAL WORKSHOPS.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—May I beg the courtesy of your columns to ask for the support of your readers of the work that is being carried on by the SOLDIERS' AND SAILORS' HELP SOCIETY (LORD ROBERTS MEMORIAL WORKSHOPS). And what more fitting occasion is there for such an appeal than to-day, September 30, and the anniversary of the birth of Lord Roberts.

Gratitude to men of the Fighting Forces and recognition of their high courage and skill, lie deep in the heart of the Nation to-day. Again in our generation we are engaged in a titanic struggle in defence of the principles of justice and freedom, and again those same qualities of determination and valour, of fidelity and service, for which Lord Roberts will ever stand as the great tradition, are winning the admiration and respect of all.

But the discerning will remember that our sailors, soldiers and airmen are paying the price of their service often in life-long disablement, in broken health and careers.

The Society stands between such victims of the conflict and what might indeed prove a hard lot in life. Help is given to the necessitous in numerous effectual ways, while in the workshops in which Lord Roberts' name is enshrined, the seriously disabled are trained in new trades and employed.

These workshops solved a formidable problem in the years succeeding the Great War when more than 3,000 of the maimed received training which enabled them to obtain work in the ordinary commercial market. Those others, whose high rate of disability precluded their finding a livelihood outside the shelter of the workshops have been permanently employed.

In consequence of the present War the Society's responsibilities are growing apace, for, in addition to its peace-time activities which must be maintained, it is striving to meet the needs of Serving men in distress, and to make adequate provision for the admission to the Lord Roberts Workshops, and subsequent employment there, of the badly disabled of the present campaign.

Despite the multifarious claims upon the generosity of the public in these difficult times, I am confident I will not appeal in vain for still further support of a great and worthy National work.

Gifts sent to me as Hon. Treasurer, Lord Roberts Memorial Workshops, 122, Brompton Road, Room T, London, S.W.3, will be gratefully acknowledged.

122, Brompton Road,  
London, S.W.3,  
September 30, 1940.

Yours truly,  
ROGER KEYES,  
*Admiral of the Fleet.*

**Notices.<sup>1</sup>**

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**UROPAC.  
IODOXYL.**

WE are informed by the makers of Uropac, Pharmaceutical Specialities (May & Baker) Ltd., Dagenham, that Uropac, in addition to 20 c.c. ampoules, is now supplied in 3 c.c. ampoules and in the form of a special solution for use in retrograde pyelography. Uropac is a contrast medium for use in intravenous urography, retrograde pyelography and other radiological investigations. The new 3 c.c. ampoules are issued for the convenience of the operator in using the small quantities required for the treatment of children. The solution for use in retrograde pyelography is supplied in ampoules of 10 c.c.

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**DAGENAN—M & B 693.****REDUCTION IN PRICE.**

WE are informed by the makers of Dagenan—M & B 693, Pharmaceutical Specialities (May & Baker) Ltd., Dagenham, that a reduction in the price of this drug has now become effective.

Dagenan—M & B 693. — Containers of  $25 \times 0.50$  gm. tablets, 5s.; boxes of  $6 \times 2.50$  c.c. ampoules 20 per cent oily suspension, 4s. 6d.

Dagenan Sodium—M & B 693 Soluble.—Boxes of  $6 \times 3$  c.c. ampoules  $33\frac{1}{3}$  per cent solution, 8s.

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<sup>1</sup> These notices are for the purpose of acquainting officers with the latest developments in therapeutics, but do not imply that the preparations mentioned have been added to the list of authorized drugs.

# JOURNAL OF THE ROYAL ARMY MEDICAL CORPS

## Corps News.

OCTOBER, 1940.

### EXTRACTS FROM THE "LONDON GAZETTE."

*Aug. 16.*—Capt. H. N. Walker (53064) retires, receiving a gratuity. *Aug. 17, 1940.*

*Aug. 20.*—The undermentioned Lt.-Cols., ret. pay (R.A.M.C.), at their own request, revert to the rank of Maj., whilst empld. during the present emergency :—

G. D. Jameson (20698). *June 24, 1940.*

A. J. Williamson, M.B. (50579). *June 25, 1940.*

*Aug. 23.*—*Short Service Commission.*—The appt. of Lt. S. P. Bellmaine, M.B. (96278), is ante-dated to Aug. 1, 1938, under the provs. of Art. 39 Royal Warrant for Pay and Promotion, 1940, but not to carry pay and allces, prior to Aug. 1, 1939.

Lt. S. P. Bellmaine, M.B. (96278), to be Capt. *Aug. 1, 1940*, with seniority *Aug. 1, 1939*, and precedence next below Capt. A. B. Fountain (85435).

*Aug. 27.*—Lt.-Col. H. R. Edwards (8567), ret. pay (late R.A.M.C.), at his own request, reverts to the rank of Maj., whilst empld. during the present emergency. *July 16, 1940.*

*Aug. 30.*—*Temporary Commission.*—Lt. R. H. S. Langeveld, M.B. (100853), relinquishes his commn. *Aug. 29, 1940.*

*Sept. 3.*—*Short Service Commission.*—The undermentioned gentleman to be Lt. on prob. *Aug. 18, 1940* :—

Cave Donaldson Cruickshank (144552).

*Temporary Commissions.*—Lt. S. E. Gordon

(100460) relinquishes his commn. *Aug. 23, 1940.*

Lt. (actg. Capt.) J. Stephenson, M.B. (100461), relinquishes his commn. *Aug. 28, 1940*, and resumes the rank of Capt.

2nd Lt. J. S. Blacklock (31762) resigns his commn. *Sept. 4, 1940.*

*Sept. 6.*—Col. E. Gibbon, O.B.E., M.B. (26231), ret. pay (Res. of Off.), late R.A.M.C., at his own request, reverts to the rank of Lt.-Col. whilst empld. during the present emergency. *July 28, 1940.*

*Sept. 10.*—Col. T. H. Scott, D.S.O., M.C., M.B. (5602), h.p. list (late R.A.M.C.), having reached the age for retirement, is placed on ret. pay. *Sept. 5, 1940.*

Col. H. G. Monteith, D.S.O., O.B.E. (11641), ret. pay (late R.A.M.C.) (Res. of Off.), at his own request, reverts to the rank of Lt.-Col. whilst empld. during the present emergency. *May 15, 1940.*

*Sept. 16.*—Col. G. F. Rudkin, D.S.O. (8088) ret. pay (late R.A.M.C.) (Res. of off.), at his own request reverts to the rank of Lt.-Col., whilst empld. during the present emergency. *Aug. 19, 1940.*

### Regular Army Reserve of Officers.

*Sept. 10.*—The undermentioned cease to belong to the Res. of Off. on account of ill-health. *Sept. 9, 1940.*

Maj. D. C. Olgilvie, M.C. (99589).

Maj. B. Varvill, M.C. (10761).

Capt. T. S. Cave (8816).

Capt. R. Stowers, M.C. (5817).

### TERRITORIAL ARMY.

*Aug. 16.*—Lt.-Col. A. T. Ashcroft, M.B. (38016), relinquishes his commn. on account of ill-health and retains his rank with permission to wear the prescribed uniform. *Aug. 15, 1940.*

Lt. (War Subs. Capt.) H. Freeman (91321) relinquishes his commn. on account of ill-health. *Aug. 15, 1940.*

Lt. (War Subs. Capt.) K. MacColl, M.B. (85816), relinquishes his commn. on account of ill-health. *Aug. 15, 1940.*

*Aug. 20.*—Capt. J. R. Tibbles, M.B. (97615), relinquishes his commn. on account of ill-health. *Aug. 19, 1940.*

Capt. Graeme Matthew Warrack (57723),

R. Scots, to be Capt. July 30, 1940, with seniority Jan. 16, 1938.

Aug. 27.—Lt. O. H. Belam (68070), from The Queen's R., to be Lt. July 26, 1940.

Aug. 30.—Lt. D. Turner, M.B. (99058), to be Capt. Aug. 31, 1940, with seniority Feb. 28, 1939.

Sept. 3.—Geoffrey Earl Crowther, M.B. (142737), from Australian Army Medical Corps to be Lt., Sept. 1, 1939, next below Lt. C. D. Weir, M.B. (93864).

Capt. (Bt. Maj.) T. E. Hastings, M.C., M.B. (47771), relinquishes his commn. on account of ill-health and is re-granted the rank of Capt. Sept 2, 1940.

Sept. 6.—Capt. W. R. Logan (40634), from R.A. (T.A.) Gen. List, to be Capt. Aug. 4, 1940, with seniority Oct. 1, 1937.

Lt. S. L. Frank, M.B. (97355), to be Capt. Aug. 31, 1940, with seniority Feb. 28, 1939.

Lt. (War Subs. Capt.) L. N. G. Lytton, M.B. (86728), relinquishes his commn. on account of ill-health. Sept. 5, 1940.

Sept. 11.—Capt. G. A. Garrett, M.B. (65684), relinquishes his commn. on account of ill-health. Sept. 9, 1940.

Lt. (Qr.-Mr.) E. Kirby (74411) relinquishes his commn. on account of ill-health. Sept. 9, 1940.

Capt. F. Appleton, M.B. (74719), resigns his commn. Nov. 1, 1939.

Sept. 16.—Lt. C. D. Weir, M.B. (93864), to be Capt. Sept. 1, 1940, with seniority July 21, 1939.

Lt. W. G. F. Clunies-Ross (65165), from R.A. (T.A.), to be Lt. July 16, 1940.

Lt. (Qr.-Mr.) T. E. Holloway (74757) relinquishes his commn. on account of ill-health. Sept. 12, 1940.

### THE ARMY DENTAL CORPS.

Aug. 16.—*Short Service Commissions.*—The undermentioned Lts. (on prob.) are confirmed in their ranks :—

A. M. Moorhead (101017).

J. D. Anderson (100500).

The undermentioned Lts. to be Capts. :—

A. M. Moorhead (101017). Aug. 9, 1940.

J. D. Anderson (100500). Aug. 14, 1940.

Aug. 23.—*Short Service Commission.*—Lt. (on prob.) G. T. Hutchinson (101194) is confirmed in his rank.

Lt. G. T. Hutchinson (101194) to be Capt. Aug. 21, 1940.

Sept. 6.—Capt. G. T. Drummond (45097) to be Maj. Sept. 3, 1940.

Sept. 10.—Col. D. Clewer (14233) (late A.D. Corps) to be Maj.-Gen. Aug. 11, 1940.

Sept. 16.—*Short Service Commission.*—The appt. of Lt. H. D. Freeman (90114) is ante-dated to Oct. 17, 1938, under the provs. of Art. 40, Royal Warrant for Pay and Promotion, but not to carry pay and allowances prior to Apr. 17, 1939.

Lt. H. D. Freeman (90114) to be Capt., Apr. 17, 1940, with seniority Oct. 17, 1939. (Substituted for the notifn. in the Gazette of Apr. 23, 1940.)

### QUEEN ALEXANDRA'S IMPERIAL MILITARY NURSING SERVICE.

Aug. 16.—Sister S. A. E. Holt resigns her appt. July 26, 1940.

Aug. 23.—Sister Miss U. N. Sheehan resigns her appt. Aug. 26, 1940.

Sept. 3.—Sister Miss D. C. Havelock resigns her appt. Aug. 19, 1940.

Sister Miss M. M. Jupe retires on ret. pay on account of ill-health. Sept. 4, 1940.

The undermentioned Staff Nurses to be Sisters :—

Miss J. S. Mowat, June 1, 1940 (with seniority next below Miss F. L. Purchase).

Miss D. F. Duckworth, July 24, 1940 (with seniority next below Miss E. M. Harding).

Miss M. Webster. July 27, 1940.

The undermentioned Prov. Staff Nurses are confirmed in their appts. :—

Miss E. M. Orrell.

Miss S. Rhys-Jones.

Miss W. D. Lindsay-White.

Miss D. M. Baker.

Miss F. L. M. Millington.

Miss M. M. Baldwin.

### TERRITORIAL ARMY NURSING SERVICE.

Aug. 30.—Miss M. Callard, A.R.R.C., Matron No. 14 Gen. Hosp., resigns on account of ill-health. Mar. 18, 1940.

Miss E. J. Stopani, Matron, No. 15 Gen. Hosp., resigns on account of ill-health. July 18, 1940.

## AWARDS.

The following awards for gallantry are announced:—

Bar to Temp. Lt. (act. Lt.-Col.) F. A. D.S.O.: Bearn, D.S.O., M.C., M.D., R.A.M.C.  
 D.S.O.: Lt.-Col. A. H. Whyte, M.B., F.R.C.S., R.A., M.C., T.A.  
 O.B.E.: Maj. C. H. C. Byrne, M.B., R. of Off., R.A.M.C.  
 Lt.-Col. (act. Col.) W. C. Hartgill, M.C., R.A.M.C.  
 Temp. Lt. (temp. Lt.-Col.) R. O. Ward, D.S.O., M.C., T.D., F.R.C.S., R.A.M.C.

Maj. R. Brooke, M.S., F.R.C.S., R.A.M.C., T.A.  
 M.B.E.: Temp. Lt. E. B. Brennan, R.A.M.C.  
 Sister N. Goodwin, Territorial Army Nursing Service.  
 Lieut. (Qr.-Mr.) S. G. Cragg, R.A.M.C.  
 M.C.: Temp. Lt. S. McCallum, R.A.M.C.  
 Lieut. A. E. Cooper, R.A.M.C.  
 Lieut. H. A. Dougan, M.B., R.A.M.C.  
 M.M.: Cpl. Act. Sgt. E. R. Weston, R.A.M.C., T.A.  
 Lce.-Cpl. H. Ford, R.A.M.C., T.A.  
 Pte. F. Marshall, R.A.M.C.

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## DEATHS.

KEBLE.—On August 18, 1940, Colonel Alfred Ernest Conquer Keble. Born in Malta, the son of Captain J. A. Keble, East Surrey Regt., he was educated at Ennis College, Co. Clare, and the R.C.S.P.I., taking the Irish Conjoint in 1890. He took the D.P.H., R.C.S.Eng. in 1907. Gazetted Surgeon Lieutenant on July 29, 1893, he was promoted Major January 30, 1905, Lieutenant-Colonel March 1, 1915, and Colonel December 26, 1917, retiring December 26, 1921. He was created an officer of the Order of St. John in 1917 and was a life member of the St. John Ambulance Association. Colonel Keble served as Chairman Ringwood Rural District Council and was a County Councillor of Hampshire. He served with the Mohmand and Tirah Expeditionary Forces on the North-West Frontier of India in 1897-1898, being awarded the Medal with two Clasps. In the Great War he served in Gallipoli, where he was wounded, in Egypt, with the Egyptian Expeditionary Force, and in Russia. Five times mentioned in despatches, he was awarded the C.B., C.M.G., D.S.O., 3rd Class Order of the White Eagle with Swords, the 1914-15 Star, British War and Victory Medals. He was A.D.M.S. Waziristan Force 1919—1921 being mentioned in despatches, and receiving the C.B.E., Medal with Clasp.

LAMONT.—At Aldershot on August 14, 1940. Lieutenant Gerald Reburn Lamont, The Army Dental Corps. Born on September 12, 1913, he qualified L.D.S.R.C.S.Eng. in 1936. He was appointed to an Emergency Commission in The Army Dental Corps on March 19, 1940.

WINDLE.—In Bournemouth, on September 6, 1940, Colonel Reginald Joscelyn Windle. Born in Derby August 18, 1860, he graduated M.B. at Dublin University in 1884. Gazetted Surgeon July 28, 1886, he was promoted Major July 28, 1898, Lieutenant-Colonel July 28, 1906, Colonel March 1, 1915, and retired December 26, 1917. He held the appointment of Physician and Surgeon Royal Hospital, Kilmainham, from October, 1907, to September, 1912. During the Great War he served in France and Belgium from 1915 to 1917, being awarded the 1914-15 Star, British War and Victory Medals.

WINGATE.—Suddenly in London on September 3, 1940, Colonel Basil Fenton Wingate, D.S.O. Born July 16, 1875, he was gazetted Lieutenant R.A.M.C. November 17, 1899. Promoted Captain November 17, 1902, Major November 17, 1911, and Lieutenant-Colonel December 26, 1917, he retired with the rank of Colonel September 18, 1928. In the South African campaign he took part in the Relief of Kimberley; operations at Paardeberg February 17 to 26, 1900; actions at Poplar Grove, Dreifontein, Vet River, May 5 and 6, 1900, and Zand River, Diamond Hill June 11 and 12, 1900, and at Belfast August 26 and 27, 1900, being awarded the Queen's Medal with five Clasps and the King's Medal with two Clasps. In the war of 1914-1918 he served over four years in France. Thrice mentioned in despatches he was awarded the D.S.O., 1914 Star, British War and Victory Medals.



## EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc., which should be in duplicate if possible according to King's Regulations.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

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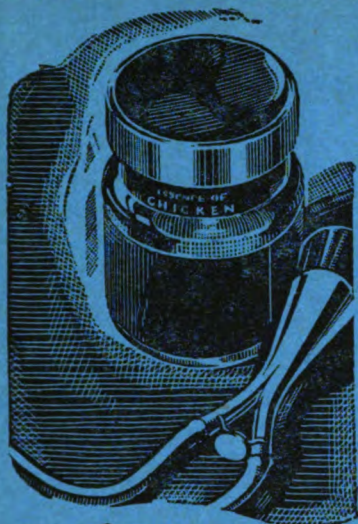
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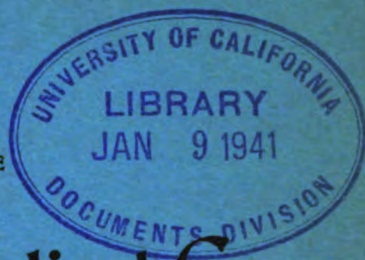
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# Royal Army Medical Corps

ISSUED

MONTHLY



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## CONTENTS

ORIGINAL COMMUNICATIONS.	PAGE	EDITORIALS.	PAGE
Military Ophthalmology. By Colonel FRANK JULEB, M.A., F.R.C.S. . . . .	281	Gas Gangrene . . . . .	316
Injuries of the Jaws and Dietary Treatment. By Major E. H. C. CAUTE, The Army Dental Corps . . . . .	289	Prevention of Tetanus . . . . .	321
Clinical Notes from a Dermatological Division. By Major R. M. B. MACKENNA, M.A., M.D.Cantab., M.R.C.P.Lond., R.A.M.C. . . . .	295		
Neurospinal Fever. Analysis of 124 Cases. By Lieutenant-Colonel R. W. CUSHING, M.B., B.Ch., R.A.M.C. . . . .	301	CLINICAL AND OTHER NOTES.	
Psychology and Clinical Practice. By Major G. DE M. RUDOLF, R.A.M.C. . . . .	310	Two Cases of Osteochondritis Dissecans. By Lieutenant-Colonel J. C. ANDERSON, R.A.M.C. . . . .	324
		Contusion of the Lung following an Injury. By Major P. F. PALMER, R.A.M.C. . . . .	326
		Massive Collapse of the Lung. By Major P. F. PALMER, R.A.M.C. . . . .	332
		CURRENT LITERATURE . . . . .	333
		REVIEWS . . . . .	340
		NOTICES . . . . .	344

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MILITARY OPHTHALMOLOGY.<sup>1</sup>

BY COLONEL FRANK JULER, M.A., F.R.C.S.,

*Consulting Ophthalmologist, late British Expeditionary Force.*

THE subjects discussed in this paper were chosen in the hope that they might prove of interest to medical colleagues who had not specialized in ophthalmology. They include ophthalmic organization in the field, ophthalmic injuries with treatment and prophylaxis, and some observations about eyes damaged by mustard gas.

*Organization in the Field.*—As in general surgery, it is our aim to treat wounded eyes as early as possible, but the case numbers are relatively small and the majority should be evacuated to a hospital at the Base. Here, as in other special cases, eye casualties are collected as far as possible into one hospital of a group, where the equipment and personnel can be centralized for maximum efficiency.

In a large expeditionary force I believe it advantageous to keep an eye specialist attached to, say, one forward unit in each corps: his duties in time of activity will be: (1) To treat and return to units light cases of eye injury and disease; (2) to aid the surgeons in deciding the fate of doubtful eyes; and (3) to treat surgically the damaged eyes of those wounded who are too ill to be evacuated. For this purpose a portable magnet may be desirable. In times of quiescence the specialist in the forward area will have plenty to do; there will always be a certain amount of refraction work, whilst disease, real or fancied, will appear in the eye as

---

<sup>1</sup> An address to the Medical Society, Dieppe Sub-Area, March 20, 1940.

in other organs. His presence will save much transport, and men will be returned to their units more rapidly.

*Eye injuries.*—These are naturally of all types. Ruptured sclerotics are common, both from contusions and from missiles. Various intra-ocular contusions are seen, such as iridodialysis, rupture of the choroid and iris sphincter, and hæmorrhages in various parts of the eye. Curiously enough, simple detachment of the retina was rare in 1914-1918, although in civil work it is recognized as being associated with trauma in a certain percentage of cases.

There are a few points in connexion with the severe eye injuries which may be worthy of mention. First is the elementary one that in nearly all gunshot wounds a foreign body has been retained, unless there is an exit wound as well as a wound of entry.

*Sympathetic ophthalmia* is now a rare disease which usually ends in blindness, and is of unknown ætiology. It is said to have been common in the American War of Secession and in the war of 1870. It seems to have been almost non-existent in 1914-1918. In France one case, in Germany eight cases were reported. This low figure was probably due to the timely removal of damaged eyes, for it is a maxim that sympathetic ophthalmia does not develop after the damaged eye has been excised. Another factor was the careful work of the ophthalmic specialists who removed prolapsed uveal tissue as early and as thoroughly as possible.

There is, however, no great urgency to remove doubtful eyes. Sympathetic ophthalmia will not start if the damaged eye is removed within two weeks of the injury; apart from pain and suppuration there is no need for hurry.

Whilst it is true that excision stops the development of sympathetic ophthalmia, once the sympathizing eye shows the signs of inflammatory iridocyclitis it is too late, and excision will do no good. In such a case it is best to leave the exciting eye, unless it is hopelessly blind, for occasionally it will retain some useful vision.

*Excision of Eyeball.*—I make a plea to surgeons to remove nothing except the eyeball and the foreign body from the orbit, and to leave every millimetre of conjunctiva in as good a position as possible. Often of course a socket that will hold an artificial eye will be impossible on account of the scar tissue resulting from the injury to the conjunctiva and orbital tissues, but repair of sockets is a difficult task, and initial conservation of the conjunctiva may make a considerable difference to the resulting appearance of the soldier.

The first important step in the operation of excision consists in the division of the conjunctiva as close to the corneal margin as possible. This sounds easy, but it is often difficult to free the membrane as far forward as is desirable. If, however, the conjunctiva is first undermined by the scissors in advance of the incision this will be much facilitated, and the maximum amount of conjunctiva will be preserved. Similarly the ocular muscles

should be divided as close to the globe as possible in order to preserve the fullness of the orbit.

In excision of badly wounded eyes the globe is collapsed, and the neat division of the recti muscles is rendered difficult because they naturally lie in the grooves of the folded sclera; they can usually be picked up most easily by the forceps, scissors and hook.

The operation may be completed by the insertion of an untied continuous suture to keep the conjunctival edges in apposition horizontally.

When suppuration is present in the globe or orbit, *evisceration* rather than excision should be performed, for in the latter operation the dural sheath of the optic nerve is cut across and an ascending fatal septic meningitis is possible.

In evisceration, the cornea and adjacent sclera are ablated, and the contents of the globe are scooped and swabbed out from the sclera completely. The operation may then be concluded by leaving the wound open, or *Lister's scleral frill* method may be used. This is a more complicated procedure, but has the advantage of avoiding a long period during which the socket is discharging from a sloughing sclera. It is not of frequent occurrence, but in severe septic wounds is to be expected. In the scleral frill operation, the initial steps are as in simple excision, namely, division of the conjunctiva around the corneal margin, incision of Tenon's capsule in the space-intervals between the recti muscles, and then the division of the four recti. The cornea and adjacent sclera are next cut away and the contents of the globe are scooped out as in simple evisceration. Three or four clip forceps attached to the scleral edge permit inspection of the interior of the globe in order to make certain that all pigmented tissue has been removed, and these are then held upwards together whilst the sclera is cut across just in front of the insertion of the optic nerve into the globe. A certain amount of care is necessary to make this cut with the stout scissors at the correct level.

*Repair of Eyelids.*—The lids are frequently torn, but it is seldom that there is actual loss of tissue, and if the distorted remnants are unravelled, it will be possible to jig-saw them together, even after several days. The vascular supply is so good that sloughing is unusual. In inserting sutures the lid margin is the most important place for accurate adaptation, and if this is not obtained, considerable discomfort will be experienced later on account of rubbing of some of the eyelashes upon the cornea. Fine needles with silk should be used.

Even when sloughing is present, as may occur in burns which have become septic, it is advisable not to remove any of the eyelid tissues, for surprising recovery may occur. Severe burns of the face are frequent among pilots of the Royal Air Force. In the initial treatment the tannic acid preparation must be kept away from the eyelids, as its resulting action tends to inhibit the movements of opening and closure. Possibly a sulphapyridine paste will be the best preventive of infection, and, when sepsis



has occurred, this will also be useful, but the treatment usually employed is the application of hot fomentations or zinc and castor oil. Early application of skin grafts may be necessary to prevent ectropion and may require repetition.

*Foreign bodies* may be superficial, intra-ocular or orbital. They are, of course, of all sizes, and many are minute. The latter remain for the most part superficial and are often multiple, the cornea and conjunctiva being at times plastered with them. Such cases are best treated lightly, for often the deeper fragments become covered with epithelium and remain quiescent.

*Perforating wounds* commonly indicate the presence of an intra-ocular foreign body. Of these, over 50 per cent are of non-magnetic material, and cannot be removed. Such eyes are usually doomed, as iridocyclitis is likely to lead to excision on account of pain. The diagnosis of intraocular foreign body is made by the presence of one or more of the following signs : a perforating wound, a prolapse of or hole in the iris, an opacity of the lens, a visible body in the aqueous, lens or vitreous, an intraocular hæmorrhage or by the employment of radiology.

The use of the *Magnet* gives an eye a chance to be rid of a foreign body and occasionally to retain vision. Unfortunately the results in military surgery are not so good as in civil work.

The varieties of the giant electro-magnet are the ring and the central core. The Mellinger model is in the shape of a ring which is brought down around the head of the patient on the operating table (fig. 1). Metal rods of varying size are supplied with the instrument, and one of these is held by the surgeon in the centre of the magnetic field and is brought down against the cornea. In the other type (the Haab) there are poles of varying conicity which can be interchanged on the front of the central core (figs. 2 and 3). A hand electro-magnet with fine points is also necessary for the completion of the operation.

Magnetic foreign bodies in front of the iris can be dealt with by the hand magnet alone, but when they are in the vitreous or bound to the retina, the large model is necessary. The usual method is to switch on the current and bring the cornea close to the pole of the instrument ; the foreign body should come forward through the jelly-like vitreous, slide round the convex posterior surface of the lens, and come up against the back of the iris. When this is seen to bulge, the current must at once be switched off and the eye turned so that the next application will tend to bring the body through the pupil. It is left in front of the iris, and the patient is then placed on the operating table ; an incision is made into the periphery of the cornea without loss of aqueous, and the foreign body is removed by the aid of the hand magnet.

Occasionally the posterior route has to be employed, the terminal of the hand magnet being introduced through a wound of entry in the sclera or through a fresh incision.

*Injuries to the Eye by Mustard Gas.*—In the early months after the outbreak of war there was a considerable correspondence in the medical journals as to the appropriate treatment of such casualties. The pathologists of the anti-gas laboratory have been fully alive to the necessity for experimental research and have been studying it for many years; the results are in the official Medical Manual of Chemical Warfare. By experiments on

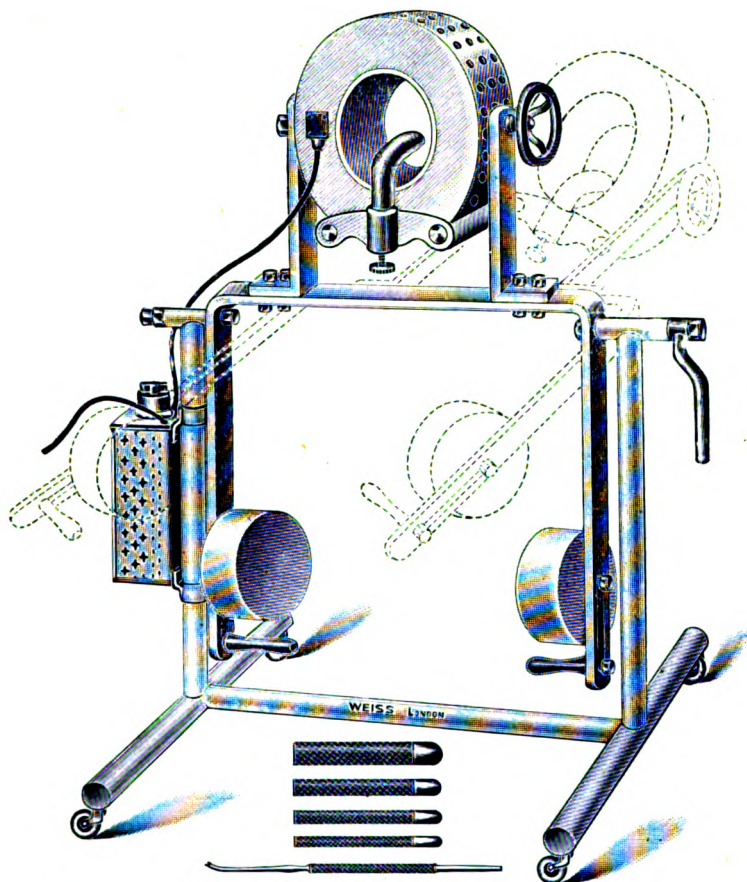


FIG. 1.—The Ring or Mellinger giant magnet, showing the electric collar which is brought down to surround the patient's face as he lies on the operating table. The rods figured below are held by hand within the collar.

animal eyes, the recent therapeutic suggestions have also been tried. Not one of them is of the slightest use.

Some figures which suggest the transient nature of the damage to the eyes from mustard gas may be of interest. It was used by the Germans first in July 1917, and in the second half of that year 52,452 gas casualties were admitted to British C.C.S.s (Whiting, 1940). Of the eye cases 75 per

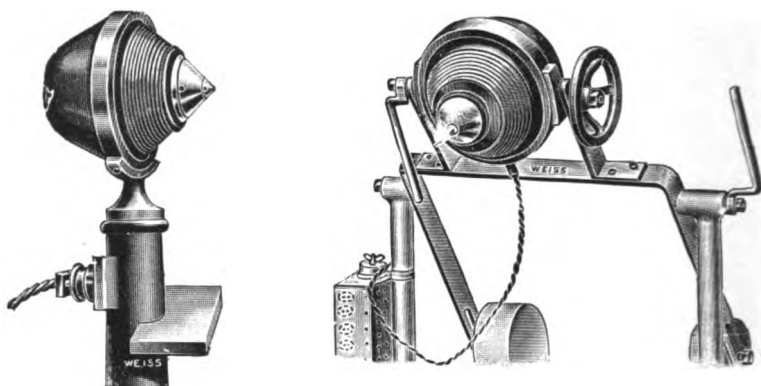


FIG. 2.—The Haab pattern of giant magnet (Weiss).

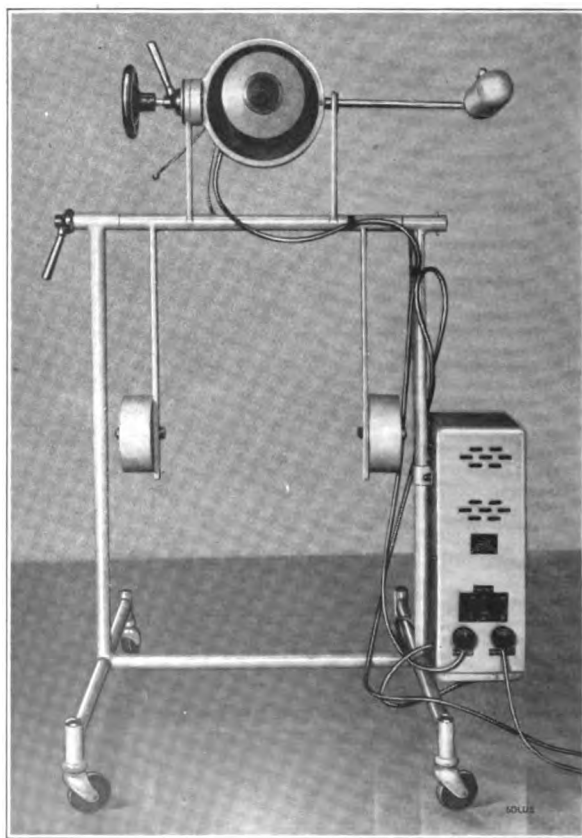


FIG. 3.—The Haab pattern of giant magnet may be set on a firm stand, or on a balanced swing frame. In the former case the patient is seated and his cornea is brought close to the pole of the magnet. Solus Electrical Company.

cent were mild and fit for duty in two weeks, 15 per cent took four to six weeks to recover, whilst severe cases with corneal involvement constituted the other 10 per cent and were away from duty for two to four months. Very few serious complications of the cornea occurred, possibly two or three only.

For more than a decade it has been recognized that some of these eyes have sustained damage which has come to show itself only after a lapse of years. This takes the form of recurring ulceration of the cornea of a painful and serious type. When healing occurs after each attack there is left a surface irregularity which distorts the vision materially; after several attacks the deterioration of sight is so severe that ordinary work may be impossible.

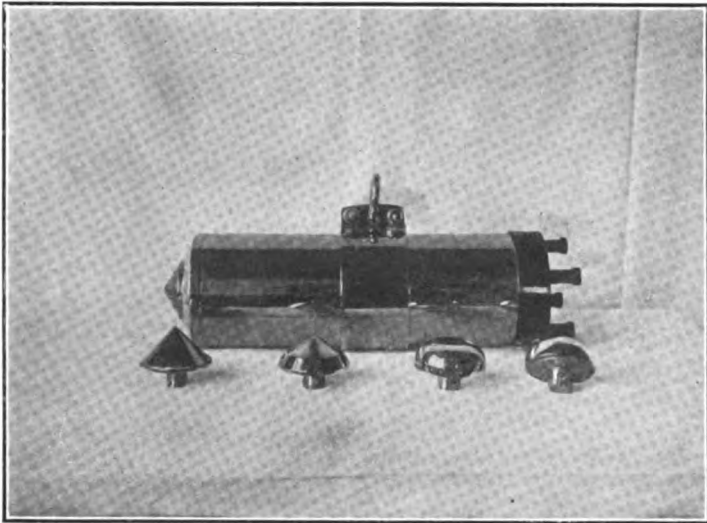


FIG. 4.—The portable army pattern may be slung from an orderly's shoulder for bed patients. In practice it is found more convenient to prop it on a table at a suitable height when dealing with walking cases. (Printed from the Medical Services Surgery of the War, vol. ii, by permission of the Controller H.M. Stationery Office.)

Suture of the eyelids is often necessary, and effects a cessation of the attacks, but the results both from the humanitarian and the financial (pensions) aspects are distressing. Recent work, however, holds out hope of relief by the fitting of moulded contact glasses, which in some cases have improved the vision by obliterating the astigmatism due to the surface irregularity and have also caused a cessation of ulceration by protecting the surface of the cornea.

*The treatment of recent gas injuries* to the eyes must not aim at much. The damage done on the surface is instantaneous; the deeper tissues will not be touched by superficial applications. Extensive schemes for irrigation of eyes in forward areas have been proposed unofficially, but have nothing

to recommend them. To permit orderlies to use such methods in inflamed eyes will occasionally cause corneal damage. The instillation of analgesics will lessen lacrimation, which may be unwise. Cod-liver oil in the acute stage is not to be recommended; Livingstone and Walker (1940) found in experimental work that it made the liquid mustard oil disperse over a wider area, causing a more extensive keratitis. They also found that bleach, even in solution of 1 : 500, was harmful to the eyes.

Treatment in the immediate stage is probably ineffective, except psychologically. Gentle irrigation with saline or bicarbonate of soda solution, followed by a drop of liquid paraffin is all that is needed. After a day or two cases with discharge should receive added attention in the form of protargol 5 per cent drops or acriflavine 1 : 2,000; if the cornea is involved, atropine is indicated. Reassurance that vision will not be affected is very important. The eyes should not be bandaged, but a protective shade will be appreciated. In the later stages, cod-liver oil drops should strengthen epithelialization.

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## INJURIES OF THE JAWS AND DIETARY TREATMENT.

BY MAJOR E. H. C. CAUTE,

*The Army Dental Corps.*

MOST dental surgeons are more or less familiar, either in actual practice or in theory, with the *local* treatment of the various types of jaw injuries. They know of, and may practise in conjunction with the surgeon, splint work, intermaxillary wiring and bone grafts. But the more remote treatment, that is the revitalization of the damaged tissues, is most often entirely neglected. Healthy tissues spring from within, and perfect body metabolism is all important. Most surgeons are likely to neglect this important fact when giving treatment for a damaged, unhealthy or septic condition. Proper dietary management will ensure not only a general feeling and condition of well-being and a brightened mental outlook, but above all provide an adequate supply of those vital materials which are essential for the recovery of the damaged tissues.

In jaw injuries the body metabolism is readily upset if the patient is deprived of the power to masticate and to prepare his food for digestion. Every effort must be made to prevent this upset. Where mastication is not possible, then the carbohydrates could with advantage be reduced, as there can be no aid to digestion in the mouth and consequently acidosis may occur, giving rise to unpleasant symptoms. In connexion with this, it is interesting to note that takadiastase is a useful natural aid to carbohydrate digestion. This modification of the normal diet is slight, and the basic principles of the normal, well-balanced diet should not be altered. The body needs then :

### A. *For General Health.*

- (1) *Proteins*—for body building and tissue repair.
- (2) *Fats*—for concentrated storage of fuel food, for energy.
- (3) *Carbohydrates*—for immediate energy requirements.
- (4) *Mineral salts*—for structure of special tissues and also for important functions.
- (5) *Vitamins*—for regulating the healthy metabolism of the body.
- (6) *Water*—for normal physical and chemical processes, such as digestion, excretion, etc.

The proportion of the first three constituents in the average diet should be 1 of protein, 1 of fat, and 4 of carbohydrates (dry weight). The inclusion of the correct type and quantity of each mineral salt required (as far as is known) is as vital to health as the known vitamins with their calculated minimum requirements, a fact commonly overlooked. Some relevant details are given below.

**B. For the Repair of Jaw Injuries.**

While making every effort to supply, even though in a modified form, the above substances, the special requirements of certain tissues in this connexion must be noted, viz.:

(1) *For Mucous Membranes.*—Vitamin A is essential for the proper functioning of mucous membranes. Deficiency of this vitamin in the diet results in keratinization, with a subsequent insufficiency of secreting fluid. Especially is this so with the epithelium of the gums at the junction with the teeth, where it may become overgrown and infected with micro-organisms, causing pyorrhœa. A diet rich in vitamin A is more effective in clearing up this condition than the application of antiseptics. It has been noted also that vitamin A is essential for the proper formation of dentine and enamel, and on a deficient diet the teeth become chalky and brittle.

The principal sources of this vitamin are the fish liver oils, green vegetables (thin dark green leaves being the richest), carrots, ripe red tomatoes, liver, fish roes, butter, etc.

(2) *For the Gums.*—A gross deficiency of vitamin C in the diet results in scurvy. One of the typical symptoms of this disease is a weakness in the walls of the blood vessels, resulting in hæmorrhages. Particularly is this marked in the gums, where soft spongy swellings sprout up between the teeth. There is also ulceration, accompanied by osteoporosis, and a loosening of the teeth. A minimum daily requirement has been calculated, and the chief sources of this vitamin are citrus fruits, spinach, watercress and cabbage, and ox liver.

(3) *For the Teeth and Bones.*—As stated above, vitamin C deficiency results in dental decay. This is a result of the breakdown of the different types of cells, concerned in the development of dentine, enamel, cement pulp, and also the bone of the jaw. These degenerative changes have been explained as follows :

The special action of this vitamin has been considered to be the production and maintenance of intercellular material, which cements the individual cells into an organ. In its absence failure to do this causes the mineral salts to drain away from the bones and teeth. The importance of this vitamin cannot be unduly stressed.

The mineral salts required are those of calcium and phosphorus and in the correct ratio. An adequate supply of these is essential for bone and teeth structure, and incidentally enhances general vitality. The majority of diets are deficient in these mineral salts.

The chief sources of calcium are cow's milk (cheese), green vegetables, egg yolk, sardines, tinned salmon, bloaters, rhubarb, blackberries, pulses, whole wheat bread, etc.

The average adult daily requirement is 0.8 gramme of calcium.

The average adult daily requirement of phosphorus is 1.3 grammes.

This gives a Ca/P ratio of 0.6.

The chief sources of phosphorus are cheese, egg yolk, offal (liver, sweet-breads, etc.), herring roes, sardines (whitebait and sprats), blackcurrants, etc., green peas, spinach, etc., dried apricots and peaches, oatmeal, whole rye and wheat.

In order to ensure the proper deposition of these minerals in the teeth and bones, vitamin D is essential. It acts by maintaining the proper and optimal level of these minerals in the blood, so that the enzyme at the site of bone-forming tissues can cause precipitation, and so deposition in the proper tissues. Incidentally and importantly, an excess of this vitamin is harmful, since it raises the blood level of calcium. This may be high enough to cause precipitation of calcium phosphate without the aid of the localized enzyme, and so result in deposition in other tissues, such as kidneys, lungs, etc.

On the other hand, a shortage of this vitamin will result in a fall in the blood level and so a subsequent shortage reaching the bone-forming tissues. The result of such a deficiency, in addition to dental decay and osteomalacia, would seriously delay healing of these tissues in injuries. The principal sources of this vitamin are the fish liver oils, egg yolk, butter, ox liver, canned salmon, etc.

Having the above outstanding requirements in mind, it is essential that the food presented to the patient be correctly cooked (to avoid destruction of vitamins and loss of mineral salts), appetising, varied and hot, not luke warm. Good meals have a cheering effect on the patient, who is often greatly depressed by an anxiety and fear that his injury will result in some degree of permanent facial deformity. With the aid of scientific feeding and good nursing the patient's recovery will be greatly accelerated, and he will give his entire co-operation to the work of the surgeons.

The well-known methods of feeding are by means of: (1) Cup and bowl—for liquid or soft diet; (2) Spoon feeding—for liquid or soft diet in those cases where the patient has lost the use of lips and surrounding tissues; (3) Nasopharyngeal—for liquid diet in those cases of extensive loss of tissue of the floor of the mouth; (4) Rectal feeding—for liquid diet in those cases where the patient is unable to swallow, or is suffering great shock.

The actual preparation of the food for the above methods of feeding may be divided into two classes, namely a liquid preparation and a soft preparation.

(1) *The liquid preparation*, making a total of about 2,000 calories a day, must always be given to those patients with fixed intermaxillary wiring or splints.

*Soup* must be strained.

*Vegetables* must be cooked and made into a very fine *purée*, or better still given in a form such as the well-known brands of homogenized foods. N.B.—Libby will supply an analysis showing vitamins and mineral contents.



*Meat*, including liver, must be finely sieved.

*Fruit* should as a rule be cooked if fresh or dried, and then made into a *purée*. If tinned, it should not be cooked but made into a *purée*.

*Drinks* may consist of tea, milk, orange juice and fruit juices.

*Note*.—The soup may conveniently be used as a vehicle to convey to the patient the more solid *puréed* particles of vegetable and meat.

(2) *The soft preparation*, making a total of about 2,500 calories per diem, allows a little more latitude.

*Soups* need not be strained unless of the vegetable type.

*Vegetables* must be made into a *purée*.

*Fish* such as herring, salmon, and bloater, must be carefully freed of bone and finely divided.

*Meat* must be ground.

*Eggs* can be made into an omelette, scrambled or soft boiled, although the latter are apt to stick to splint work.

*Bread* should be given in the form of fresh whole wheat crumbs, or crumbs made from the many varieties of whole wheat biscuits which are obtainable.

*Fruit* can be given in the form of tinned fruit (only the best brands should be used, to ensure maximum amount of vitamin C), stewed fresh fruit (stewed in as short a time as possible, to avoid undue loss of vitamin C), choosing those with a high calcium and phosphorus content.

*Drinks* as described in the liquid preparation.

To those dental surgeons of the Services who intend to avail themselves of a knowledge of dietetics to aid them in their work, I suggest that it is absolutely essential to instruct the nursing staff, otherwise results may be disappointing. The subject is a fascinating one, and links together a number of medical subjects of which they have knowledge. It should be a simple matter to arouse their interest, and the result will be intelligent co-operation and a shelving of some methods of invalid feeding, the results of which few *healthy* people could survive.

To the necessarily brief outline, given above, the following details are of interest :

(1) Since vitamin A is manufactured by sunlight in the green plant, the amount is proportional to the exposure, thus thin dark green leaves (e.g. spinach) are richer than the pale inner leaves of cabbage, lettuce, etc. This vitamin is stored in the liver of animals, which is thus a good source, provided the animal's food contains vitamin A or its precursor. This fact also explains its presence in such concentrated amounts in fish liver oils, since some authorities have suggested that green algæ are the primary source and are eaten by small fish, and these in turn by larger fish, and so on until the concentrated vitamin reaches the cod, halibut, etc.

Vitamin A being fat soluble is found in milk, and concentrated in its fat, i.e. butter. This amount varies, and depends on the diet of the cow. Thus summer butter is better than winter, and imported butter from grassy countries, for example New Zealand, is often to be preferred. The colour is no guide to the vitamin content as was thought at one time.

(2) Vitamin D is of special interest, and peculiar in that an excess dose is harmful. A classic story often quoted is of the over-zealous mother, who thought that if a little was good a lot would be much better. The result was fatal, causing almost complete calcification of the lungs of her child.

The relationship between this vitamin and sunlight is also of great interest. The vitamin can be manufactured under the skin from a precursor by exposure to sunlight. This is one explanation for the prevalence of rickets in slums, and among women living in purdah. The value of sunlight having been successfully demonstrated for some time, yet another warning must be given of the dangers of too sudden or over exposure, since the active principle, namely the ultra-violet rays, is harmful to the lens of the eye, and the toxic effect of skin burns is too well known to be repeated.

(3) Vitamin B, which is important for digestion and general health, is mostly lost in the milling of flour. Incidentally, the calcium content is reduced to about two-thirds at least of the total. The same fact applies to the polishing of rice and other cereals. The vitamin B content of wholemeal bread is about six times that of white.

The fascinating story of the slow deterioration of the teeth of the inhabitants of the island of Tristan da Cunha is correlated with the increased consumption of white flour and sugar, as a result of more visits to the island of steamers, which at one time called only twice a year (when 83 per cent of teeth were free from caries). A comparison of the teeth of Maoris and New Zealanders is a telling indictment against the use of white flour, which has had its calcium content depleted during its manufacture.

On no account should white flour, polished rice (or any other cereal from which the embryo or germ has been removed), or foods made from these, be allowed in the dietary of hospital patients.

Since the habit of eating white bread results in the widespread incidence of digestive disorders (due to shortage of vitamin B) and almost universal incidence of some form of dental decay (due to the loss of mineral salts) in so called healthy people, how much more vital is it to supply these factors to patients attempting to regain health.

(4) Although Dr. James Lind's famous "Treatise on Scurvy" appeared in 1755 and Sir Richard Hawkins had made valuable observations as far back as 1593, yet there are few people to-day who recognize the relationship between scurvy and diet. The Navy took advantage of the information and in 1795 issued an ounce of lemon juice per man per day. The Mercantile Marine followed later. Yet in the Great War, the tragic story of General

Townshend at Kut in 1915, and the occurrence of 11,000 cases of scurvy in 1916, brought sharply to the minds of the controllers of the nation's food supply the disastrous effects of continuing to ignore the warning of scientists against fatal reductions in certain essential foodstuffs.

From its beginning in December, 1916, till its end in May, 1917, the Ministry of Food failed in its task. Luckily the warning against the stoppage of imports of fresh fruit was not entirely ignored. Scurvy is apt to be the result of an unscientific or careless organization of food supplies on a large scale, since this vitamin is extremely sensitive, viz. it is very easily oxidized. In fact the vitamin content of fresh lemon juice which is high, rapidly deteriorates on standing alone. Also it is destroyed by the addition of alkalis, such as soda, used so commonly in the cooking of green vegetables. Incidentally, rapid cooking is better than slow cooking, since the oxygen is quickly driven off, and there is likely to be less oxidation and so less loss of the vitamin. The less cooking, the better, of course. Yet, canners claim that the preservation of fruits and vegetables *in vacuo* preserves the vitamin C since the contents are heated in the absence of oxygen. Practical observations by a scientific body, working for the French Government, tend to confirm this claim.

Yet vitamin C is easy to obtain. In emergency, the pure extracted vitamin (ascorbic acid) could be used. Fresh citrus fruits contain high percentages. It is interesting to note the high value of fresh paprika, parsley, and horseradish, which thus make a valuable as well as attractive garnish to invalid diets. Dried fruits and vegetables contain practically no vitamin C, yet sprouted seeds, e.g. dried peas, rapidly regain a good amount. A shortage of vitamin C in the body of a patient is easily detected, since the vitamin is excreted in the urine, and is easily estimated by chemical means, and there is a subnormal figure in these cases. A large dose given, say in the form of fresh orange juice, would not show an increase excreted equal to that in a normal control patient, since a certain amount is retained in the body up to a certain level. This technique could be adopted as a valuable check on hospital diets.

Finally, if it can be said that "an army marches on its stomach," how equally important it is to ensure the most rapid recovery of our casualties by using every available bit of knowledge known up to date.

Let us not lag behind the intelligent layman in putting into the front rank the most neglected yet vital aid to health and recovery. We must not repeat the errors due to ignorance, which resulted in such tragic lessons as Kut; and it must be remembered that the German Government lost the last war largely because they preferred "guns to butter."

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## CLINICAL NOTES FROM A DERMATOLOGICAL DIVISION.

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DERMATOLOGY is both an art and a science. An art is to some degree empirical, but the progress of a science depends on the consolidation and evaluation of the knowledge gained by earlier workers in the same field. For this reason a comparison of the findings of dermatologists during the war of 1914-1918 and the experience of a dermatological division in a base hospital in England during the first six months of the present war may be of interest.

The second chapter of the Official History of the Great War, Medical Services, Diseases of the War, Vol. 2 is devoted to skin diseases. In this chapter Lieutenant-Colonel A. M. H. Gray, R.A.M.C. (T.), draws attention to the following points :—

(1) That in one army infections of the skin, scabies and pyrexia of unknown origin accounted for 90 per cent of all sickness. Pyrexia of unknown origin was usually proved to be trench fever and a sequel of pediculosis, “while in most cases infections of the skin were due to pediculosis and scabies, one or both.”

(2) That the incidence of pyodermia (e.g. impetigo, ecthyma and boils) was relatively high. Scabies was responsible for 64.9 per cent of all forms of pyodermia and caused more than half of the common forms of skin disease in the army.

(3) That in the impetigo group of skin diseases four types predominated : (i) Impetigo contagiosa ; (ii) ecthyma or deep impetigo ; (iii) impetigo secondary to scabies ; (iv) infected (impetiginized) seborrhœic eczema.

(4) That “during the whole course of the war a peculiar disposition to eruptions of a seborrhœic type was manifest. Not only was the incidence of seborrhœic eczema unduly high but the skin became peculiarly sensitive being easily affected by slight degrees of trauma.”

(5) That pediculosis was more common in the forward areas than in the rear.

(6) That, with regard to treatment, the slow response of ecthyma to many remedies was particularly noteworthy, and that after sulphur therapy in the treatment of scabies, dermatitis often developed five to seven days after the use of sulphur had been discontinued.

It is of some interest to compare *seriatim* the findings detailed in the above paragraphs with our experiences during the last six months. Unfortunately, owing to obvious reasons, our conclusions cannot be substantiated

in this account by statistics, but our findings may be presented as follows :—

(1) That the two skin diseases, scabies and pyoderma, which were most prevalent in the Army during the last war are again the most prevalent skin diseases in this war.

(2) No new or recently recognized skin disease has yet arisen, or shown any evidence of becoming of statistical importance. By “new or recently recognized disease” is meant a pathological condition which, while recognized by specialists, is not widely known to the members of the medical profession. For example, plantar warts, caused by a filter-passing virus have been uncommon. A few cases of *tinea cruris* have been treated, but interdigital epidermophytosis has been rare.

(3) In the impetigo group of diseases the predominance of the four types described by Lieutenant-Colonel Gray [1] is very noticeable.

(4) The “peculiar disposition to eruptions of a seborrhœic type” is again manifest. The skin of the affected persons has again been noticed to be hypersensitive, relapses occurring with extraordinary rapidity in some instances.

(5) In our division the incidence of pediculosis has been low. In the last war the incidence of this disease was low in the home country, and high in the forward areas.

(6) With regard to treatment, ecthymatous ulcers have been found to be indolent, despite the use of modern remedies, and the phenomenon (unusual, in our experience, in civilian practice) of dermatitis developing five to seven days after sulphur therapy has been noted.

It will be seen from the foregoing observations that the similarity between our experiences and those of dermatologists in the last war is somewhat striking. In view of this it may be asked if there have been any advances in our knowledge of the ætiology and treatment of cutaneous diseases which enable the dermatologist to deal more satisfactorily with these types of cases.

Firstly, with regard to scabies. This disease is usually diagnosed correctly by medical officers in charge of units when it has fully developed and has extended widely over the body and limbs; but many medical officers fail to recognize the condition in the earlier stages when there is mild itching (usually when the patient goes to bed) affecting such areas as the anterior axillary folds, the inner borders of the elbows, the wrists, the buttocks, and the neighbourhood of the umbilicus. In civilian life scabies is usually dealt with by municipal hospitals or cleansing stations, and in recent years many men must have qualified without having had any opportunity of seeing cases under treatment. For this and for other reasons there has been a tendency to flood the base hospitals with cases of scabies, although in many (but not all) instances the patients might have received treatment at their units. In this connection it may be useful to

quote from the "History of the Great War" [1], where MacCormac's technique for the treatment of the disease is detailed as follows :—

"On the first day the patient was thoroughly rubbed with soft soap for fifteen minutes. He then entered a warm bath where he lay for twenty minutes ; during the last five minutes the infected sites were gently scrubbed with a soft brush. . . . After drying, a liberal quantity of sulphur ointment (B.P.) was rubbed over the whole body below the neck. . . . This inunction was repeated on the second and third days. On the fourth day, but not before, the patient was given a second bath and supplied with clean clothing and bedding. Such articles as socks, wrist straps, and the string of identification discs also required disinfection."

There is no doubt that this technique is excellent, but it is open to the criticism that the supply of baths with copious hot water is not always easy to obtain ; in theory, if the technique is fully carried out, one bath can only accommodate twenty-four patients in eight hours ; in practice, probably only about eighteen patients can use it in that time.

We have found Marcussen ointment very satisfactory. The formula<sup>1</sup> is given in the Pharmacopœia of the Aldershot Command, but not all dispensers have the skill to prepare it properly. Ung. potassii polysulphidi of the British Pharmaceutical Codex is a similar preparation but is said to be only one-seventh the strength of the Army product.

Marcussen ointment has two advantages in comparison with sulphur ointment when the application of the ointment has to be carried out by the patients themselves : firstly, it can be spread more easily over the skin, and secondly, its colour allows patients and orderlies to see at a glance if any area has been left untreated.

Our technique is for the patient to have two quick baths each day. During his second bath he is given a suitable brush with which to open up

<sup>1</sup> UNGUENTUM MARCUSSEN.—(1) To prepare sulphur lye, dissolve 27 ounces 2 drachms of potassium hydroxide in 26 ounces 3 drachms of distilled water, and when solution is complete add 8 ounces 6½ drachms of sulphur sublimata. Heat gently on a water bath, and when solution is complete add another 8 ounces 6½ drachms of sulphur sublimata. Add more sulphur sublimata as long as it continues to dissolve up to a total of 30 ounces 6½ drachms. Then add 26 ounces 3 drachms distilled water, cool, allow to stand for one week or longer, and then decant into another vessel.

(2) To prepare the ointment :—

A.	Vaselini	..	..	..	..	..	..	7 ounces 2 drachms
	Adipis lanæ	..	..	..	..	..	..	7 ounces 2 drachms

Mix well and add sulphur lye, 14 ounces 1½ drachms.

B.	Zinci sulphatis	..	..	..	..	..	7 drachms 12 grains
	Sodii hydroxidi 20 per cent solution	..	..	..	..	..	1 ounce 3 drachms (by weight)

Mix well and add B to A.

C. Add paraffinum liquidum to the above mixture till the total weight is 2 lb. 3 oz. 2 dr. Benzaldehyde 5 drachms may be added to conceal the odour.

the burrows and expose the parasites and ova. After the second bath Marcussen ointment is applied from the neck to the feet. The patient is not confined to bed, and is available for suitable work during the day. The first bath is taken in the morning, and in this way for about five hours every day the skin is cleansed of the ointment. The average case of severe generalized scabies is cured in three or four days, and by the two-bath technique the incidence of sulphur dermatitis is minimal. In a consecutive series of one hundred cases, not complicated by ecthyma, the average stay in hospital was 4.6 days. In the same series, the average number of days on which Marcussen ointment was applied was 3.7 days. In only one case did post-scabietic pruritus develop, and this case had the longest stay in hospital (17 days).

Recently Wernick, Kulchar, Weininger and Huber [2] have drawn attention to a method of treating scabies wherein the body is painted with a 40 per cent solution of sodium thiosulphate which is allowed to dry for



Ecthyma. Typical lesions on the inner aspect of the leg.

fifteen minutes and thereafter a solution of 5 per cent hydrochloric acid is applied. The procedure is repeated after fifteen minutes. This "new" treatment is said to have been used in the Somme area in 1916 [3]. The period of treatment does not appear to be shorter than if Marcussen ointment is used, for treatment in hospital for three to five days is the average time given by some authorities, but the method has the advantage that it requires a minimum of bathing. We hope to carry out some experiments with benzyl benzoate at a later date.

With regard to the prevention of sulphur dermatitis, blonde types and persons with red hair develop sulphur dermatitis very readily, and it is necessary to watch their progress under sulphur therapy more carefully than brunettes. Usually dermatitis develops first on the forearms and flanks, and these areas should be carefully examined at the daily medical inspection for the first signs of dermatitis.

Ecthyma is "a deep or dermic impetigo." The site of election is the lower legs, usually on the inner aspects. The lesions are shallow ulcers

surrounded by a red areola ; the vividness of the erythema indicates the degree of activity of the process. If left untreated the lesion is covered by a dirty yellow crust which hides the underlying ulcer. If the adjacent skin is pressed, a bead or two of pus may ooze through the crust. When the crust is removed the cavity of the ulcer is found to be filled with purulent liquid. Ecthyma usually develops as a complication of scabies, and we have learnt always to look for this disease in a patient whose sole complaint is of "sores on the legs." Occasionally an ecthymatous ulcer develops at the site of a small injury usually in the neighbourhood of the internal malleolus. Within a short period similar lesions, usually discrete, develop on the same limb, proximal to the original sore. When the process is active, and the surrounding erythema is vivid, rest in bed, removal of the crusts and the application of kaolin poultices seem to be the best method of treatment. When the surrounding erythema has diminished, it appears to be better not to keep the patient entirely at rest. To quicken the circulation of the leg by allowing a certain amount of exercise seems to be beneficial, but each case must be judged on its own merits. Treatment with sulphanilamide or M & B 693 is helpful in many cases, and probably the use of the Kromayer water-cooled mercury-vapour lamp would be beneficial. We have used potassium permanganate baths, and antiseptic dressings such as eusol, flavine, perchloride of mercury, etc. For the indolent ulcer, painting the sore with 3 per cent silver nitrate solution (made either with water or spirits of nitrous ether) followed by a dressing of 1 per cent ammoniated mercury ointment was recommended in the last war, and is satisfactory. Magnesium sulphate paste, and Watson Smith's iodine paste [4] are both useful in certain cases, but the treatment of choice for all cases is as follows : A tablet of M & B 693 is crushed to fine powder. The scabs are carefully removed from the lesions, and the powder is sprinkled thickly on to each ulcer. Lassar's paste is then applied thickly over the lesions so as to keep the powder from being washed away by the sero-purulent discharge. A suitably folded piece of gauze covers the paste, and a light bandage is applied. In our opinion this routine cures ecthyma more quickly than any other measure.

The relatively very high incidence of seborrhœic dermatitis, and the hypersensitivity of the skin in these cases cannot be fully explained by modern theories, but the work of H. W. Barber and others on the "seborrhœic state" enables us very tentatively to suggest the following matters for consideration. Firstly, soon after the last war, Barber and Semon [5] published in this Journal a paper showing that most seborrhœic cases had a very acid urine, and that the alkaline tolerance of seborrhœic subjects was high. If sufficient alkali is given by the mouth to make the urine alkaline, the cure of seborrhœic dermatitis usually is hastened. It is probable that, so far as the recruit is concerned, the increased muscular activity (and possible psychological causes as well) of an Army life lead to an unaccustomed drain from, if not to an actual depletion of, the alkaline reserve, and in this



way one of the factors associated with the "seborrhœic state" is intensified. Secondly, it is recognized that whilst a seborrhœic usually likes a diet rich in carbohydrates, such a diet has a very deleterious effect. For the seborrhœic subject an Army diet is too rich in carbohydrates. It is possible that these two factors may help to account for "the peculiar disposition to eruptions of a seborrhœic type." It would seem to be advisable that patients discharged from hospital after suffering from seborrhœic eruptions should be kept on an alkaline mixture, and should be warned to keep their carbohydrate intake as low as possible.

It was found in the last war that cases of "infected or impetiginized seborrhœic eczema" affecting particularly the scalp, beard and moustache areas, responded satisfactorily to starch and boracic poultices and calamine liniment. These cases are not uncommon, and in 1940 we have not discovered any very superior method of treatment. In many of them foci of sepsis such as chronic infection of maxillary antra, carious teeth, etc., may be demonstrated, and if these foci can be treated the risk of recurrence is lowered. Barber has described two types of seborrhœic person: "the one, usually fair complexioned, is flushed, robust, active and in later life often plethoric; the other, usually dark, is pallid, coarse-skinned, pigmented and indolent." We have the impression that the majority of cases of "infected or impetiginized seborrhœic eczema" (often briefly called "infective dermatitis") occur in persons of the first type.

#### SUMMARY.

A brief résumé of the clinical experience of dermatologists in the War of 1914-1918 is given, and a comparison is made between their findings and the experiences of a dermatological division in a base hospital in England during the first six months of the present War. Attention is drawn to certain difficulties in the treatment of the more prevalent cutaneous diseases.

In submitting these notes for publication, it is my pleasant duty to acknowledge my indebtedness to Colonel R. P. Lewis, *D.S.O.*, late *R.A.M.C.*, not only for his permission to put them forward, but for his encouragement during their preparation.

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## CEREBROSPINAL FEVER.

## ANALYSIS OF 124 CASES.

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THE cases herein analysed were admitted to the Military Isolation Hospital, Aldershot, during the winter of 1939 to the end of May, 1940. The type of case seen in this period appeared to show some clinical deviations from the normal as exhibited in the war of 1914-1918 and it was thought worth while to analyse the cases and report on the treatment with soluseptasine by the intravenous route.

## ONSET AND INCIDENCE.

The onset of the fever was very sudden. Many went to bed feeling quite well and awoke in the morning with intense headache, frequently accompanied with vomiting. The actual incubation period cannot be definitely stated, but it appears to be of very short duration, mostly from twenty-four to forty-eight hours. Some cases, however, had various

Age Incidence				Service Incidence			
Age (yrs.)	Cases	Age (yrs.)	Cases	Period	Cases	Period	Cases
1	1	25	2	1 wk.	1	9 mths.	2
14	1	26	2	2 wks.	1	10 "	2
15	1	27	2	3 "	8	11 "	5
16	1	28	1	1 mth.	4	1 yr.	4
17	1	29	3	2 mths.	4	2 yrs.	1
18	4	32	2	3 "	12	4 "	1
19	18	36	1	4 "	18	6 "	1
20	26	38	1	5 "	16	7 "	1
21	29	40	1	6 "	24	10 "	1
22	14	43	1	7 "	14	25 "	1
23	7	44	1	8 "	3		
24	3	51	1				

Time Incidence							
Week ending		No. of cases admitted		Week ending		No. of cases admitted	
11/11/39	..	1		17/3/40	..	2	
18/11/39	..	1		24/3/40	..	8	
23/12/39	..	4		31/3/40	..	4	
7/1/40	..	2		7/4/40	..	5	
14/1/40	..	3		14/4/40	..	9	
21/1/40	..	12		21/4/40	..	3	
28/1/40	..	8		28/4/40	..	2	
4/2/40	..	8		5/5/40	..	2	
11/2/40	..	14		12/5/40	..	3	
18/2/40	..	7		19/5/40	..	2	
25/2/40	..	7		26/5/40	..	4	
3/3/40	..	8					
10/3/40	..	5					
							124

symptoms, especially sore throat, lasting from one to seven days before the appearance of the headache. Others complained of a feeling of general malaise for a similar period of time. The fulminating septicæmic type is even more sudden than this. A man may be stricken to the ground in a fit simulating *petit mal*, others suddenly become unconscious and fall into various stages of coma. The tables on page 301 show the incidence according to age, length of service, and date of occurrence.

The types of cases were classified as slight, 28 ; moderate, 49 ; severe, 41 ; fulminating septicæmic, 6.

#### SIGNS AND SYMPTOMS.

The clinical picture was that of an extremely ill patient with the anxious expression of one in distressing pain. The lips and cheeks were pale and grey, showing a definite toxæmia with much blood destruction, leading in the worst cases to an apparently moribund state. The skin was damp with perspiration. The commonest and most distressing symptom was that of intense and intolerable headache. On approaching the bedside or stretcher one was frequently met with an urgent appeal for something to relieve the headache, which the patients said they could not stand any longer—one man actually asked for a razor with which to cut his throat. This symptom was so constant and distressing that one could almost diagnose the case on that alone, and perform an immediate lumbar puncture in confidence of finding a turbid cerebrospinal fluid under pressure. The removal of anything from 30 to 50 c.c. of fluid would relieve the distressed condition immediately.

The next important sign was that of nuchal rigidity with intense pain on attempting to approximate the chin to the chest. This was noted in 116 cases, and 34 of them were described as having "marked rigidity." Retraction of the head was absent in 42, and only 5 showed anything like marked retraction. No condition of opisthotonos as described was seen in any case. Vomiting was fairly constant and sometimes appeared as quite an early sign contemporaneous with the headache. This was noted in 56 cases, being severe and prolonged in 24. Strange to report, we had a number of bad and persistent vomiters, all admitted in one week in April. Nothing was discovered to account for this. The vomiting generally lasted from one to four days. During this stage soluseptasine was found to be extremely valuable.

The mental condition of the patient was very often abnormal. Two definitely distinct types existed. One type had considerable cerebral irritation. My notes show that 2 patients were very violent and required constant and forcible restraint, 4 were noisy, 13 rambling and delirious, 10 irrational and disorientated. The other type showed varying degrees of mental depression and were very sorry for themselves : 4 were unconscious in coma ; 37 were stuporous, confused, and lethargic ; 11 were just drowsy and apathetic. Fifteen patients were conscious and rational, and 2 were

actually mentally alert. The 4 cases in coma were *in extremis*, collapsed, with cold extremities, and very cyanosed and practically pulseless. They all recovered.

The temperature was no guide in establishing a prognosis or a conception of the severity of the case. Only 3 cases had a temperature of 103° F. on admission; 102 cases were below 100° F., and in 64 the temperature was not above 99° F. The pulse-rate was almost like a temperature chart and much more indicative of the severity of the infection, and in its charted rate was more informative of the progress of the case than the temperature chart. A slow pulse-rate was evident only in cases of increased pressure of the cerebrospinal fluid or in full dosage of the sulphonamide drug used. The volume was noted as "poor" in 28 cases, but hard in 17. The reflexes were not very valuable from the point of view of diagnosis—for example, Kernig's sign was noted as doubtful or absent in 47 cases, knee-jerks were absent in only 18 cases, sluggish in 24, and exaggerated in 7. Brudzinski's sign was present in only 8 cases. Plantar reflexes were: 5 flexor, 42 extensor. Ankle clonus was present in 4 cases. Respirations were a little altered from the normal. Purpuric and petechial rashes on the trunk and limbs were present in 28 cases; 2 extremely severe cases had extensive areas of hæmorrhagic purpura; and 24 had the "spotted fever" petechiæ, 12 of them very extensive and marked.

*Joint Signs.*—Three patients had rigid spine, 7 had stiffness and pain on manipulation of joints in upper and lower limbs, 7 complained of pain in the back and 2 of abdominal pain, in 1 the jaw was locked, and 9 had their teeth strongly clenched. One patient who was unconscious had his fists strongly clenched and his arms firmly fixed in flexion at the elbows.

*Ocular and Auditory Signs.*—Four had conjunctivitis, 13 strabismus with diplopia, and 31 a marked photophobia; 2 showed ptosis of one or other eye; 1 developed a severe condition of iridocyclitis and lost the vision of that eye. Two were deaf on admission and 5 others had a transitory partial deafness.

*General Signs.*—In fulminating cases all showed meningeal signs; but the predominant clinical picture was one of acute generalized toxæmia, and some were presumably septicæmic in nature. In other cases the clinical picture simulated typhoid with pyrexia and a macular rash; in these one could isolate the meningococcus by blood culture.

#### PATHOLOGY AND BACTERIOLOGY.

The cerebrospinal fluid was turbid in varying degree. Slight turbidity pointed to lumbar puncture having been performed at an early stage of the disease, and often it became more turbid on later lumbar puncture. In some cases the fluid was almost too thick to pass through the needle. Mostly the fluid was under pressure—and in some cases to such a degree that it actually spurted through the needle. In a cell count the polymorphs varied from 2 to 52,600 per c.mm., this maximum being in a soldier's child

aged 3 months: 27 had up to 5,000 polymorphs per c.mm., 44 had 10,000, 38 had 20,000, 12 had 30,000, and 3 had over 30,000. A small polymorph count indicates a localized infection, and one not particularly invading the theca.

The globulin was constantly increased in amount; and sugar was decreased, down to total absence: in 16 cases it was normal; in 38 reduced in quantity; and in 70 *nil*. Protein was constantly increased, excepting in cases of a very low polymorph count. Any hæmorrhage into the spinal canal, accidental or otherwise, gives a definite increase in amount commensurately with the polymorph cell count. The actual amount shown was: 46 up to 200 mg. per ml., 26 up to 300 mg., 20 up to 400 mg., 25 up to 500 mg., 3 up to 600 mg., 2 up to 700 mg., 1 up to 1,100 mg., and 1 up to 1,200 mg.

Chlorides were constantly diminished, varying between 600 and 700 mg. per ml.

The meningococcus was nearly always found in direct smears, but was scanty or absent in culture in cases with a low polymorph cell count or in cases in which treatment had been started before lumbar puncture was performed. In some cases in which symptomatic reasons necessitated repetition of lumbar puncture within twenty-four to forty-eight hours the laboratory reported an almost normal cerebrospinal fluid. Blood culture showed that three cases had normal cerebrospinal fluid, but the meningococcus was isolated in blood culture and in blood films peripherally.

In all cases save one the differential blood-count showed a total white cell count varying from 10,000 to a maximum of 52,000 per c.mm. The polymorph percentage was high, varying from 70 to 94. The one case showed a leucopenia. Lymphocytes invariably decreased from normal 30 per cent to as low as 2 per cent. There was no change in eosinophils or myelocytes, and the mononuclear count was not altered to any appreciable extent. This is not of much prognostic value.

*Differential Diagnosis.*—Cases in which the initial diagnosis of cerebrospinal fever or “suspected cerebrospinal fever” was changed were: influenza, 8; scarlet fever, 1; tonsillitis, 6; pharyngitis, 3; chronic bronchitis and emphysema, 1; acute enterocolitis (infant), 1; rheumatism with rheumatic purpura, 1; acute belladonna poisoning (accidental), 1. Cases of cerebrospinal fever previously diagnosed otherwise were: post-epileptic state, 1; ? diphtheria, 1; early pneumonia, 1.

#### COURSE OF THE ILLNESS.

After the initial intravenous injection of soluseptasine, with lumbar puncture, within twenty-four or even twelve hours in the majority of cases the picture was entirely changed. The temperature fell to normal, the intensity of the headache was diminished and in some cases entirely eliminated, nuchal rigidity lessened, and vomiting ceased or lessened in persistence and severity. By this time sulphapyridine is given orally

without subsequent vomiting, in diminishing strength of dose, until in eight or nine days treatment is stopped and the patient proceeds to a sustained and uneventful recovery, is allowed up in from thirteen to twenty-one days, and is discharged on five weeks' convalescent leave after four to five weeks' hospital treatment. Vomiting ceased in most cases after the initial dose of soluseptasine and lumbar puncture. In 4 cases it continued for two days, in 9 for three days, and in 7 for four days. The period during which headaches persisted was: three days, 2 cases; five days, 2 cases; six days, 3 cases; seven days, 4 cases; nine days, 4 cases; ten days, 2 cases; twelve days, 1 case; seventeen days, 3 cases; twenty-three days, 1 case. The length of time patients were kept in bed was thirteen days and fifteen days in 1 case each, sixteen in 2 cases, nineteen in 2, twenty in 18, twenty-one in 17, and twenty-four in 12. They were generally up and about all day in four weeks. No physical signs of cerebrospinal fever were present after eight days in 1 case, ten in 2 cases, eighteen in 4, nineteen in 12, twenty-five in 26, twenty-seven in 5, thirty-two in 7, thirty-six in 10, and thirty-seven in 11.

*Post-convalescent Condition.*—After five weeks' convalescent leave 25 declared themselves perfectly well and fit; 48 complained of early fatigue on exercise and occasional dizziness; and 6 complained of pain in the back. 42 exhibited the effort syndrome in varying degree of severity: these cases gave only a fair response to the exercise-tolerance test, with some distress. 6 were found unfit for duty at present and were sent to the general hospital for further treatment and final disposal by a medical board; 48 were recommended for a period of light duty under the supervision of a regimental medical officer, and 25 were returned to their unit as "fit for duty." In the examination of these cases and in the decision as to their further disposal consideration was given to the psychological aspect of the situation. The majority of the cases consisted of young militiamen who had unfortunately contracted the infection after a very short period of service; and after four to five weeks' hospitalization followed by five weeks' convalescent leave at home were, as it were, conscripted again, with the ensuing shock to their nervous system. It was decided, and I think reasonably, that after a period of light duty to enable them to settle down once more into military service they would very shortly "make good" as soldiers.

*Mortality.*—Among the 124 cases there were 4 deaths, which gives a fatality rate of 3·2 per cent. Since the end of May there have been 11 more admissions, and as no other deaths have occurred the total rate is brought down to 2·9 per cent.

#### TREATMENT WITH SULPHONAMIDES.

The introduction of the chemotherapeutic agents known as sulphonamides, or sulphanilamide, for the treatment of cerebrospinal meningitis has completely changed the clinical and prognostic pictures of the disease.

Whereas it was previously greatly dreaded because of its high mortality figure of 30 to 60 per cent, or even 80 per cent in fulminating cases, this terror has largely been lost, since the mortality rate is reduced to less than 3 per cent in all cases. In pre-sulphonamide days patients remained in hospital for at least six weeks, with a further six weeks' convalescence, and often were invalided out of the Service. Under the new treatment men have been discharged from hospital in four to five weeks, and after five weeks' convalescence have been returned "fit for duty" or, in some cases, "fit for light duty" under the supervision of the regimental medical officer, being returned to full duty after a short period.

In treatment it is essential to achieve a high concentration of the drug at the earliest possible moment and to maintain this concentration at an effective level over a predetermined period of time to suit the particular case. As soon as a case is even suspected of being one of cerebrospinal meningitis, and even before lumbar puncture is performed, treatment should be begun. There is no doubt that by adhering to this principle many lives are saved.

Sulphonamides can be given by all routes—orally, subcutaneously, intramuscularly, intravenously, or intrathecally. There are three chief drugs in this order of merit: soluseptasine, sulphapyridine, and sulphanilamide.

(1) Soluseptasine (M & B 137): disodium para ( $\gamma$ -phenylpropylamine) benzene-sulphonamide- $\alpha$ ,  $\gamma$ -disulphonate.—This drug is supplied in ampoules of 5 and 10 per cent solutions for intramuscular, or, better still, intravenous injection. Soluseptasine is a sulphonamide with the addition of a benzyl group, which very greatly reduces its toxicity. If the patient is comatose or too ill to take anything by the mouth, or is vomiting, 20 c.c. of 5 per cent, or 10 c.c. of 10 per cent soluseptasine is injected intravenously into one of the veins over the antecubital fossa. This can be repeated in four to eight hours, according to the severity of the case, and may be continued for three or four days, until the patient's initial signs and symptoms have disappeared. The results are so constantly good and the effects so speedy that this is the drug to be recommended for routine treatment at the outset in all cases except perhaps the mildest. It is certainly preferable to any other form of chemotherapeutic drug that has been produced up to the present time. Further research work is being done in this field. 85 per cent of the cases either at the onset or at some subsequent period were treated by soluseptasine intravenously.

(2) *Sulphapyridine* (M & B 693, Dagenan): 2-sulphanilyl-aminopyridine.—This is made up in the form of compressed tablets for oral administration, each containing 0.5 gramme of active substance. The adult dosage is: initial dose, 3 grammes (six tablets) finely crushed, in milk (or, even better, taken in the tablet uncrushed), followed in six hours by 2 grammes, repeated four-hourly for twenty-four hours, day and night, then reducing to 1½ grammes four-hourly for twenty-four hours; then to 1 gramme at the same intervals for the same period. Later 1 gramme may be given three times

daily. If the patient vomits or suffers from nausea a teaspoonful of sodium bicarbonate in warm water is given half an hour before the dose is due, or 2 minims of liquor atropinæ in water or 2 minims of acidum hydrocyanicum dilutum. It may be necessary to split the dose, giving half the number of tablets two-hourly instead of the full number four-hourly. Sometimes a second lumbar puncture may have to be undertaken to reduce the pressure in the cerebrospinal canal. Treatment should be continued without remission for three to five days after the temperature has fallen and headache has been absent or very mild for a period of nine days.

*Sulphapyridine Soluble* (Dagenan Sodium).—This is merely the sodium salt of sulphapyridine, and is soluble. It may be introduced intravenously in those patients who cannot take the insoluble form of the drug by mouth or in whom it has been found difficult to obtain an adequate blood concentration by means of oral administration. Each ampoule contains 1 gramme of the drug in 3 c.c. of diluent; this dose may be given at four-hourly intervals to a total of 4 or 6 grammes, after which it should be possible to continue treatment per oram. Sulphapyridine soluble must be diluted in three or more volumes of normal saline. There are very grave drawbacks to the intramuscular route in the administration of this drug. Unless injected very deeply into the muscle it may give rise to subcutaneous necrosis of tissues with abscess formation and ulceration. Furthermore, intramuscular injection often gives rise to a considerable amount of pain. Attempts have been made to anæsthetize with novocain the whole site of the injection, including the entire track of the needle. Considering the unfailing results and the simple safe operation of injecting the rival drug soluseptasine intravenously, it is difficult to find justification for advocating the use of sulphapyridine soluble.

(3) *Sulphanilamide* (synonyms: sulphonamide P, colsulanyde, streptocide, prontosil album): *p*-aminobenzene-sulphonamide.—This preparation is put up in 0.5 gramme tablets. The initial dose is 4 grammes (eight tablets), followed after four hours by a dose of 2 grammes, and the same dose thereafter, four-hourly, day and night, as with sulphapyridine. The tablets should be powdered and taken in milk. If there is no sign of reaction to this treatment the course should be repeated or be changed to soluseptasine. In all cases it is recommended that a change over be made to the oral compound as soon as possible, but, at least with soluseptasine, there need be no hesitation about reverting to the intravenous route should vomiting recur or "gagging" at taking the drug by the mouth. When the meningitis appears to be controlled, as judged by the fall in pulse-rate and temperature and the disappearance of clinical signs, the treatment should still be continued in doses of 0.5 gramme three times daily for three to five days, to prevent any chance of relapse.

Often the reaction to treatment, especially in those cases which appear at first sight to be *in extremis*, is truly dramatic, the picture changing completely within twenty-four hours or even overnight. One evening a serjeant



was brought in with his fists tightly clenched and elbows so strongly flexed that three orderlies found difficulty in straightening his arms so that an intravenous injection could be given. 20 c.c. of 5 per cent soluseptasine was administered, and this dose was repeated after four hours. In the morning the patient was quite conscious, and was found actually sitting up in bed.

Another striking case was a man who on admission was practically dead. He looked like a corpse, and smelt like one. He was pulseless and hardly breathing. His body was covered with large patches of areas of purpura. His veins were so collapsed that it was very difficult to gain an entry with the needle, and the blood withdrawn into the syringe was almost black. His life was saved by two doses of soluseptasine, within the first four hours. He was eventually transferred to the Cambridge Hospital for further "tonic" treatment.

Once the diagnosis has been made no further lumbar punctures are performed unless signs of intracranial pressure arise, when the operation can be repeated and the pressure in the cerebrospinal canal registered; also, at this or any subsequent lumbar puncture, the concentration of soluseptasine in the cerebrospinal fluid can be determined. This should be from 4 to 5 mg. per 100 c.c. for several days after treatment is initiated. Further, the percentage of concentration in the blood itself can be estimated, and future dosage thus decided.

Some cases persist in showing a small rise of temperature for some days after they have obviously reacted satisfactorily to treatment. This need give rise to no apprehension, for the temperature will eventually settle down to normal and remain there. Adverse reactions reported in the medical papers, with cyanosis, acidosis, drug fever, dermatitis, dizziness, headache, leucopenia, hæmaturia, jaundice, neuritis, agranulocytosis, or hæmolytic anæmia, are never seen even after repeated doses of soluseptasine, which has been used throughout in cases of initial and persistent vomiting lasting for two or even four days.

With drug treatment some further important matters require attention. Where persistent vomiting occurs, whether due to the meningitis or to the drug, the patient rapidly becomes dehydrated, and fluids so lost must be made good so that a satisfactory balance may be maintained between blood concentration and ordinary excretion. To establish this approximately four pints of fluid should be taken daily. With sulphapyridine some clinicians have found jagged arrow-shaped crystals in the urine, with hæmaturia, pyelitis, and other signs of renal damage.

It is important, further, to see that the diet offered contains no sulphur; for instance, eggs are dangerous, as are other foods with a high sulphur content. For a similar reason magnesium sulphate and other sulphur-containing drugs are contraindicated. A good laxative for these patients, who are often constipated, is liquid paraffin or a simple enema. Treat the patient kindly, for a drastic purge may lead to intractable diarrhoea, with consequent dehydration and its unhappy results.

The following rough outline of treatment may be of value when dealing with some of the complications seen after administration of full doses of sulphapyridine :

*Cyanosis*.—This should not be taken too seriously. Do not withdraw the drug, but see that the diet is sulphur-free. Give 0.5 to 1 gramme of methylene-blue daily.

*Retention of Urine*.—Catheterize until bladder functions naturally.

*Insomnia*.—Chloral and bromide or pulv. ipecac. co. Paraldehyde or morphine only if urgently required.

*Herpes Labialis*.—Often seen in patients who have been given sulphapyridine in a crushed form. Soluseptasine ointment has been advocated, but has not proved satisfactory. Other more serious complications such as deafness, iritis or ophthalmia or other intra-ocular infections, synovitis, etc., require the specialist's attention.

From beginning to end a complete record of the treatment must be kept on A.F.I. 1237, giving the date and hour, the drug and dose administered, and the route of entry, and this document or a copy must accompany the patient if he is transferred from one medical unit to another, so that over-dosage may be avoided. More particularly is this necessary when the transfer takes place from a small medical unit—for example, a medical reception station—to a general or isolation hospital.

#### TECHNIQUE FOR THE INTRAVENOUS INJECTION OF SOLUSEPTASINE.

It is advisable to have one or two orderlies present to steady the patient's arm, especially if he should be restless, resistive, or irrational. Choose the arm which appears to be furnished with the best veins. Extend the arm fully at the elbow. In applying the tourniquet round the upper arm leave one end in a loop instead of pulling it right through ; thus when it comes to removing the tourniquet one tug of the free end will loosen the knot.

The soluseptasine (20 c.c. of 5 per cent or 10 c.c. of 10 per cent), previously warmed to blood heat, should be ready in the syringe, with all the bubbles of air carefully excluded. Wash the skin over the chosen vein with surgical spirit, penetrate the vein, withdraw a little blood into the syringe, release the tourniquet ; then, watching the patient's face, slowly inject the solution. Withdraw the needle, place a thick pad of gauze over the site of puncture, and flex the arm. If the veins fail to fill satisfactorily on applying the tourniquet repeated flexing of the arm at the elbow will bring about the desired result. Should it prove difficult to insert the needle into a vein, another vein should be chosen, perhaps on the other arm, but care should be taken not to " blow up " the vein.

I wish to give full credit to the excellent and untiring professional care and ability shown by the medical and nursing staff of this hospital, and thanks to Lieutenant-Colonel C. J. Little, *O.B.E.*, the Assistant Director of Pathology, Aldershot Command, who has done all the pathological investigations, and to others for their kind co-operation.

## PSYCHOLOGY AND CLINICAL PRACTICE.<sup>1</sup>

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PSYCHOLOGY, the science of the mind, covers the whole field of activities and even, as comparative psychology, extends to the behaviour of the lower animals. This evening, however, we are dealing with the relations existing between the practice of medicine and surgery and that of psychology.

Although a comprehensive review of psychology is unnecessary, a brief description of some psychological processes may be of interest. The well-known feeling of inferiority may give rise to signs and symptoms designed to draw sympathy towards the sufferer. The sympathy so obtained makes the individual feel important and consequently reduces the inferiority feelings. Such feelings may progressively become stronger in intensity. The patient may draw more and more away from the environment in order to avoid the constant realization of failure. On the other hand, a compensatory mechanism may be invoked. The patient will over-act to overcome the feeling of inferiority. He will strive hard to succeed in directions other than those of his failures. He may become bombastic or a bully. This type of person frequently feels happier and more contented when up against difficulties and produces much of the best work in the world. As there is a constant feeling of mild discontent with efforts, there is a continual struggle for improvement.

The power of the super-ego should be stressed. During the early years of life, the child is dependent upon adults for its knowledge of the best way in which to behave. It is compelled by one or more adults to behave in certain ways and so develops ideas of what it should do and what it should not do. This early conscience is the adult's super-ego. It recedes into the unconscious part of the mind, but remains there as an unreasoning conscience. Freud called it a tyrant because it urges its owner to act in certain ways solely because the early teaching must be obeyed. The child brought up strictly and by fear will have a more tyrannical super-ego than one brought up by reason and affection. The power of the super-ego is reduced by knowledge that one acts in certain ways for social reasons rather than for unknown reasons instilled in early life by an all-important being.

Now, if an older child or an adult acts in a manner contrary to the demands of the super-ego, a guilt-feeling arises. The reason for this feeling is usually unknown, but a fear, "I know it is wrong," develops. This is

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<sup>1</sup> Read at No. 1 General Hospital, B.E.F., November, 1939.

commonly called the conscience. The intensity of this feeling may be so slight that it is readily pushed aside and forgotten by the conscious mind; it may be so strong that severe remorse and depression ensue. A conflict may develop. This is a struggle between the principles of the super-ego and the instinctive desires. Continuation of this conflict without a victory for either the desires or the super-ego leads to anxiety; the individual is perplexed. An anxiety neurosis shows itself and bodily or physiological changes take place.

If the sensation of guilt is severe, self-destructive tendencies may ensue. These may be shown by chronic destruction, such as alcoholism, laziness, over-spending or any behaviour that adversely affects the future. Alternatively, the self-inflicted punishment may be acute in nature. It may cause road or other accidents. Lack of care, perhaps deliberate, may cause the accident. Some people are more prone to accidents than are others. Finally, suicide is the supreme example of self-destruction. It is a method of ending a situation intolerable to the individual. The depression consequent upon the morbid feelings of inferiority based, in their turn, on feelings of guilt can only be abolished by the complete expiation of death.

Another common type of reaction is that in which the literal meaning of a term is acted. Vomiting may occur for months or years from disgust although the original stimulus lasted for a few seconds. A patient who believes literally that he is "sick unto death" may vomit, expecting that if he is seriously ill he should be sick, despite the two meanings of the word sick.

This brief account of some of the mechanisms underlying the appearance of psychological signs and symptoms resembling those of organic disease is very incomplete, but is hoped to be sufficient for the purposes of this paper.

In general medicine, palpitation with, frequently, irregular action of the heart, is one of the commonest psychological conditions seen. The heart is felt to beat, either constantly or intermittently. The conscious beating may be regular or irregular. An irregular irregularity, resembling fibrillation, is sometimes found, but extra-systoles or a few regular beats are more common. As the subconscious mind is nearer the conscious level during sleep than in the waking state, these attacks are usually more common at night than in the day, but any memory that rouses anxiety or fear will produce the cardiac reaction. Pain around the heart is often psychological, more particularly, if it occurs without effort. The organic cardiac pain is not necessarily associated in the mind of the patient with the cardiac region. It is usually retrosternal and in the upper limbs.

Diarrhoea is another symptom of anxiety and fear. A common example is the diarrhoea occurring in examinees waiting for oral examinations. Wittkower has shown that a high proportion of patients with mucous colitis suffer from psychological difficulties. An example of improvement with psychotherapy is that of a woman, who had been passing blood and

mucus from seven to ten times daily. Her treatment was not completed when mobilisation took place, but she had ceased to pass blood, and mucus was being passed about three days a week.

Changes in the secretions of the alimentary tract are normal reactions to anxiety and fear. The mouth becomes dry and the alterations in the gastric secretions may be partly responsible for the formation of gastric ulcers. Flatulence, with or without aerophagia, is another very common psychological condition and, consequently, generalized or localized, but moving abdominal pain is frequent. Vomiting may be psychological. An example is that of a woman who was operated on for appendicitis, but continued to vomit. Two more operations were performed for adhesions. None were found, but the vomiting continued. Finally, the house surgeon, Dr. C. H. Whittle, asked if he could try psychotherapy. In three weeks he had stopped the vomiting which had been present for months. He found a father-fixation, that is an abnormal emotional attachment to the father. When this was explained to the patient, the vomiting, presumably due to disgust at her own incestuous love feelings, stopped.

Backache, generalized or localized, can be psychological in origin as perhaps in visceroptosis, but, in my experience, is usually organic. Septic foci can often be found.

Vasomotor instability with blushing is usually a sign of anxiety from conscious feelings of guilt, although that associated with hyperthyroidism may be entirely chemical in nature.

Much has been written about hay fever and asthma, but there is no doubt that attacks of either can be produced by emotion, and not only by proteins. There is a strong psychological background.

Anxiety associated with a high blood-pressure is common, but it is the fear of the pressure that is the troublesome symptom. Better not to take the blood-pressure than to worry the patient over having a level above normal.

Hysterical paralysis, fits, headaches and paræsthesiæ are examples of some of the many psychological conditions occurring in neurological practice. Ross quotes an interesting case of paralysis. A regular cavalry sergeant was thrown by his horse when retiring with his men from the advancing enemy. He was dragged, with one foot in the stirrup, for one-quarter of a mile. With the exception of grazes and bruises, there were no injuries, but complete paralysis was present in the limb which had caught in the stirrup. The patient remained in this condition for 11 years when he received psychotherapy. The investigations showed that the paralysis was not from any fear of death, but from the disgrace that the sergeant felt that he, a regular cavalryman, should have been thrown from his horse in front of his men. He had repressed, that is consciously forgotten, the whole incident. When he was made to recall it, the paralysis disappeared. This case demonstrates how a symptom may be localized in an area of the body connected, in the patient's mind, with a preceding incident.

Although a patient showing hysterical fits seldom copies an epileptic fit exactly, very good imitations of it can be produced. An imbecile mongol at Leavesden was able to imitate an epileptic fit, if given a penny, so accurately that junior nurses were often deceived. Hysterical patients may injure themselves in fits, but usually accidentally. Soap in the mouth produces foam but, only occasionally, is urine voided. In one case, a girl of 13 years, urine was passed into the bed on the first day in hospital, but never again as she had appreciated the accompanying discomfort.

Psychological headache is very variable. The complaint is often of pain behind the eyes, of pain moving from place to place, of sensations which cannot be described as pain. A sensation of swelling of the head is usually psychological, but a feeling of bursting may be due to pituitary tumour. Tenderness over the painful area suggests neuritis or affection of the bone, and unilateral headache makes migraine a probability. The pain of cerebral tumour is usually stationary.

Tics and torticollis, especially the paroxysmal type, are usually psychological in origin and the former are sometimes difficult to differentiate from isolated movements of chorea. Paræsthesiæ, so common in disseminated sclerosis and Raynaud's disease, may be psychological in origin. If so, they are more likely to be present persistently than in the sclerotic condition. Anæsthesia, either hemi- or of the glove-and-stocking variety, is very common in hysteria. It must not be confused with the exactly similar glove-and-stocking type met with in peripheral neuritis.

Pruritus may be psychological and can be localized or general. It is usually troublesome and persistent. Urticaria, although frequently due to protein sensitization, may be psychological and angio-neurotic œdema is invariably psychological in nature. It may bear no relation to nerve distribution, as in one case in which the distal half of the dorsum of the right hand became swollen from time to time without any other area being affected. Psoriasis will suddenly appear after emotional crises and the whitening of hair in a night is proverbial.

In general surgery psychological conditions will ape many organic states. Œsophageal spasm is similar to spasm of any other part of the alimentary tract and, like spasm of the colon, is, if no organic imitation is present, psychological. Occasionally, control of the muscles of the alimentary tract is possible. One patient after each meal regurgitated his food into his mouth and chewed it like a cow chewing the cud if he stood up. If he was forced to sit down, he vomited his meal. Hurried emptying of the stomach, like hurried emptying of the lower bowel in nervous diarrhœa, may be psychological in origin.

Patients constantly desiring operations, and unfortunately, often obtaining them, are usually masochists wishing to suffer to atone for some guilt or wishing to attract someone's sympathy to them. Menniger cites a case who went from surgeon to surgeon and had twenty-eight abdominal operations. Although this is an extreme instance, patients are seen frequently who

have had three or four operations apparently unnecessary surgically. The masochistic patient plays upon the emotions of the surgeon. These patients soon find out which surgeons operate readily. Psychotherapy would prevent many of these needless operations.

Although the stomach has been shown to drop during emotion, visceroposis is not psychological in origin. The symptoms associated with this condition and with that of floating kidney are entirely psychological, unless, of course, there are definite kinks produced by the displaced organs.

The pain and sensation felt in phantom limbs may be psychological in nature. If the end of a divided nerve is stimulated by scar tissue, the patient will feel the pain as if in the missing limb, but this cannot be regarded as psychological. If, however, the missing limb is felt to be in some special position connected with a previous event, or if it appears to move in some special way, the nature of the sensation, but perhaps not its origin, can be psychological. Riddoch cited two cases at the meeting of the Association of British Neurologists, 1939. In one case a phantom hand was always felt in the position in which it was as it was blown off while holding a bomb. In the other, the phantom arm was always felt to be moving across the trunk, but Riddoch gave no event associated with this sensation.<sup>1</sup>

Although difficulty in the commencement of micturition and frequency are frequently due to organic conditions, they may be psychological especially where chiefly nocturnal. At this time, items pushed into the subconscious mind during the day come nearer the surface and may cause physiological results.

Impotence, unless definite structural damage is present, is psychological as is also *ejaculatio præcox*.

Vertigo is frequently psychological, but this type is usually less definite and more variable than the organic form, whether cerebellar or vestibular. Vertigo unaffected by emotion and which is always in the same direction, is usually organic. The vertigo of a Ménière's syndrome may cause the patient to fall as if shot. Psychological vertigo never does this, but makes the patient stagger.

Although non-infective coryza is usually due to protein sensitivity, some forms are psychological. An instance was that occurring in a patient immediately she went into bright sunlight.

Deafness and aphonia can both, of course, be psychological in origin,

Blindness may be hysterical. Fields of vision diminished approximately equally in all quadrants is a common hysterical manifestation. Photophobia is frequently psychological. The eye can be trained to stand very bright light, and if an individual whose conjunctivæ do not become hyperæmic in bright light wears dark glasses psychological trouble should be suspected. Blepharospasm is another psychological condition in some

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<sup>1</sup> Since this paper was read, I have had an opportunity of treating a stationary phantom limb by hypnotic suggestion. With the exception of a small area where the foot was wounded, the phantom was abolished.

cases. A very successful pianist used this as a means of acquiring a much-needed rest from the piano. He never read the music, but felt he could not face his audiences as they would see him blinking. This is another example of the symptom being fixed on a region mentally associated with the psychological trouble.

In gynæcological work, backache is a very common symptom, but, in my experience, it is not often psychological in nature. Usually some organic cause can be found. Amenorrhœa is a very frequent accompaniment of abnormal psychological states and the return of the menses is of good prognostic omen. Unless there is local irritation vaginismus is entirely psychological. Its basis is a deep-set objection to sexual intercourse, either in general or with one particular person. Until recently pruritus vulvæ was regarded as psychological. This condition is a good example of the folly of diagnosing psychological conditions solely on account of the apparent absence of any organic cause. Usually, no psychological cause is present, and lately, marked improvement has been obtained with heavy œstrogenic therapy.

Lastly, two points in connexion with diagnosis may be mentioned. First, no condition should be finally diagnosed as psychological solely because no organic cause has been detected. However thorough the search, an organic cause may be impossible to find. Second, psychological symptoms may often be superadded to organic trouble. An individual with a small limp may deliberately exaggerate it when crossing a road, so that motorists can see readily that he cannot hurry. Ross quotes a case who complained of abdominal pain. As no organic cause could be found, the doctor believed the condition to be psychological, especially as the pain was always worse when he was in the room. Within a month, the man had died of carcinoma of the pancreas.

This is a very imperfect account of some relationships existing between psychological medicine and physical medicine. Much has been omitted, but it is hoped that these few, isolated observations, will be of some assistance in practical work.

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## Editorials.

### GAS GANGRENE.

NOTES on the diagnosis and treatment of gas gangrene with a suggested scheme for the Bacteriological Investigation of War Wounds have been published as M.R.C. War Memorandum No. 2. The memorandum has been prepared by the Medical Research Council War Wounds Committee and the Committee of London Sector of Pathologists, with the following objects in view :—

(1) To provide a clear and simple synopsis of present knowledge of gas gangrene based on the clinical and pathological experience of the War 1914-18, and on more recent experience in Spain, in France and elsewhere.

(2) To indicate in what directions existing knowledge of this condition, and of war wounds in general, most needs to be extended and how that extension may be most rapidly and effectively secured.

(3) To lay down a detailed scheme for a combined clinical and bacteriological study of war wounds which may be adopted as a minimal procedure by any hospital or bacteriological department willing to co-operate in this investigation.

The Committee consider that selected groups of clinical and laboratory workers should devote themselves to particular problems, and with this object four such groups have already been formed in the London Sector area. It is also thought to be highly desirable that arrangements should be made in as many areas as possible for study along similar lines. Surgeons and pathologists encountering cases of typical gas gangrene and of less degree of anaerobic infection should make careful returns of all such cases upon the Army form and supplement which have been widely issued for the purpose.

Analysis of the data so obtained would be a useful complement to the findings of those hospitals where a more intensive attack upon particular problems is planned.

In Editorials and other papers we have already dealt with the main facts given in the papers on gas gangrene in the Official Medical History of the War, 1914-18. The experiences in Spain have also been described and numerous papers printed on the treatment of the disease with the sulphonamide group of drugs. We have also described the experiments of Legroux and his results obtained with sulphonamide. In the M.R.C. Report there is an introduction, then follows Section II dealing with the bacteriology of gas gangrene and clinical diagnosis.

The causal organisms of gas gangrene are spore-bearing anaerobic bacilli belonging to the Clostridium group. The micro-organisms commonly met in order of frequency are : *Cl. welchii*, *Cl. septicum* (*Vibrio septicum*) and

*Cl. oedematiens*. These bacteria produce their effect by local invasion and intoxication of the tissues, particularly the muscles leading to necrosis. All three types, particularly *Cl. oedematiens* produce an active toxin. In addition, less pathogenic types of Clostridium may be present, such as *Cl. tertium*, *Cl. sporogenes* and less frequently *Cl. histolyticum*, and *Cl. aerofætidum*. Usually several species of Clostridium are present together in anaerobically infected wounds. Occasionally a single species may be present. Cases of gas gangrene in which only one species of anaerobe can be found usually yield *Cl. welchii*: this organism plays a role of major and perhaps primary importance in gas gangrene of the human tissues. In mixed infections *Cl. welchii* and *Cl. sporogenes* are commonly found together.

It is pointed out under clinical diagnosis that gas gangrene is a clinical conception. In the last war and in this war Clostridia have been found in large quantities in wounds that at no time have shown signs of gas gangrene. The clinical diagnosis may be confirmed by the identification of Clostridia in the wound, especially if they predominate in the specimen or swab, but the disease should not be diagnosed on bacteriological data alone. The conditions in a contaminated wound that result, on the one hand, on mere local infection and on the other in spreading gas gangrene, are not fully understood, but infection is more readily established in wounds containing necrotic tissue.

From the bacteriological point of view gas gangrene may be controlled in two distinct ways: (1) Anti-bacterial (removal of pabulum and introduction of bactericidal substances), and (2) antitoxic measures. Antisera capable of neutralizing the toxins of *Cl. welchii*, *Cl. septique* and *Cl. oedematiens* are available, but these agents have no direct action on the bacteria.

Since the war 1914-18 knowledge of the Clostridia group of bacteria has advanced considerably. The diffusible toxins are better defined and more powerful antitoxic sera are available. Both *in vitro* and *in vivo* many of the bacteria are susceptible to the action of drugs of the sulphonamide group. Experimental data suggest that the most effective control of fully developed gas gangrene may be obtained by the combined use of surgery, sulphonamide chemotherapy, and antitoxins. Indications of the best line of treatment will probably come from the records of cases in which therapeutic measures based on a definite plan have been carefully checked by repeated bacteriological investigations.

In a typical case of gas gangrene the onset is acute—and in a few hours the patient may be *in extremis*. Cases have been recorded in which established gas gangrene was present within three-and-a-quarter hours of wounding. The fact that the onset may be delayed four or five days does not diminish the possibility of a severe infection.

The commonest site is muscle, usually a single muscle or group of muscles. The infection usually spreads longitudinally up and down the wounded muscles from the site of the lesion and has little tendency to spread from one muscle to another. A whole limb may be affected if the blood supply

has been interfered with. Gas gangrene may occur primarily in subcutaneous or areolar tissue where there has been extravasated blood. The best example of this is a very fatal retroperitoneal infection occurring as the result of tangential wound of the abdomen without visceral injury.

The most important symptoms are : Rapid pulse ; vomiting, may be the first suspicious sign of the onset of infection ; pain ; pyrexia ; general appearance of the patient, when toxæmia is severe the skin becomes muddy in colour and may even suggest a mild jaundice. If the wound is of the open type the surface is dry, later exudate dark in colour and extremely offensive appears. The smell of these wounds is characteristic ; when the dressings are removed the smell is not unlike that of acetylene gas. If the wound is of the penetrating type, the point of entry being plugged with extruded muscle, the following signs may be present : swelling of the limb ; crepitation due to escape of gas from subcutaneous tissue through holes in the deep fascia. The area involved may not correspond to the area of infection of the deeper tissues. Crepitant subcutaneous tissue is not necessarily infected and amputation flaps may be fashioned from skin and fascia where crepitation has been noted ; the flaps should not be sutured. A tympanitic note on light percussion is always present in massive gangrene.

The skin changes are very variable and do not correspond to the infection in the underlying muscles ; apparently healthy skin may be lying over seriously infected muscle. As swelling increases the skin becomes dirty brown, then mottled purple patches appear, finally greenish yellow areas in which blebs form.

In retroperitoneal infection a peculiar bronzing of the skin overlying the infected area has been noted.

At operation certain muscle changes may be observed : (1) the normal purplish-red changes to brick-red. Contractility is lost and the muscle does not bleed. Gas bubbles may be seen or crepitation may be felt in the muscle, the fibres of which stand out more prominently and are friable ; (2) the brick-red colour changes to olive-green, the muscle is more friable and tends to break up on handling ; (3) the muscle becomes greenish-black. is glistening and softens to a pultaceous mass.

This description of muscle changes applies in the main to *Cl. welchii* or to mixed infections in which *Cl. welchii* or *Cl. septicæ* are contributing. It may be quite inapplicable to the rarer forms of gangrene due to *Cl. œdematians* or *Cl. septicæ* where the predominant features may be toxic œdema with absence of gas, and only an extreme hyperæmia of muscle with no necrotic change.

In the superficial muscles such as the sartorius and biceps humeri, the change between normal muscle and infected brick-red, non-contractile muscle can be very clearly seen. The line of demarcation is lighter in colour, and a ridge may be palpable between healthy and infected tissue. The ridge is due to the initial swelling of the muscle in the early stages of infection.

Gas bubbles may be seen in X-ray films taken before operation. But gas may be shown apart from the existence of gas gangrene and its extent often has no relation to the clinical state.

It has been pointed out in numerous articles in the *Journal* that gunshot wounds are nearly always contaminated by bacteria and infection of the tissues bordering on the track occurs after a lapse of four to eighteen hours. Excision of the contaminated wound should be performed at the earliest opportunity. Through and through wounds, especially those made by bullets, can usually be left alone ; excision is unnecessary.

When a wounded man comes under observation at a later period the chief aim of the surgeon is to provide free drainage by appropriate incisions. But if there is any suspicion of gangrenous infection of muscle the wound must be widely opened up and muscles affected must be ruthlessly excised. The technique of wound excision is then described in the Memorandum. It is much the same as the description given by Roux and Leriche which was published in the *Lancet* on February 3, 1940. Roux describes four stages. We gave a short extract from their paper in the *March Journal*. The War Wound Committee state after disinfection of the skin with soap and water followed by spirit and ether, surgical incisions which aim at débridement should be made parallel to the axis of the limb. If skin requires removal not more than a few millimetres wide should be excised. In facial injuries skin should never be sacrificed. The tissues of the wound are excised with a sharp knife or scissors, particular attention being given to bruised tags of fascia and to the muscles in proximity to the wound-track. Wide excision of muscles must be made if there is change of colour, loss of contractility on mechanical stimulation, or failure to bleed. Intra-muscular spaces containing blood must be opened up and blood and blood-clot removed. Deep fascia should be freely divided in the long axis of the limb in order to permit subsequent swelling of muscles without strangulation and impairment of blood supply. Detached fragments of bone should be removed. Great caution must be exercised not to remove too many loose fragments lest the stability of the limb be imperilled. In gunshot fractures due to impact of the missile against the bone the risk of infection is trivial, but if the wound-track traverses the bone infection is inevitable unless the skeletal injury is thoroughly treated and the medulla adequately opened up. All retained foreign bodies must be removed. It is preferable to excise one or more strips of muscle longitudinally rather than cut across some important muscle. Important nerve and vascular structures must be preserved. The greatest care must be taken to preserve intact vessels that remain patent. Injury to nerves may end in life-long disability. In no circumstances should muscles, fasciæ or deep layers of the wound be sutured with catgut. The propriety of primary suture of the skin will depend on the experience of the surgeon, the interval between the reception of the wound and time of operation, and the prospect of early transportation. If there is any doubt about the harmful effect of these contingencies the

skin is best left unsutured. The growing use of the sulphonamide drugs and an increasing appreciation of the value of plaster of Paris as perhaps the best means of ensuring rest and of facilitating transport, may in the future modify surgical caution in the matter of primary suture, but the special experience of the surgeon is thought to count the most.

The prophylactic treatment of gas gangrene is stated to be treatment at any time *between the receipt of the wound and the onset of symptoms*. An essential part of such treatment is the surgical procedure of wound excision; other measures include the injection of polyvalent gangrene antitoxin and the use by the mouth and locally of drugs of the sulphonamide group. The prophylactic dosage of polyvalent serum is as follows: 3,000 international units *Cl. welchii* antitoxin, 1,500 international units *Cl. septique* antitoxin and 1,000 international units *Cl. œdematiens* antitoxin given either intravenously or intramuscularly.

The following methods of prophylaxis by sulphonamide or sulphapyridine have been proposed. *Oral*: First dose 1·5 grammes of either compound dissolved in hot 1 per cent citric acid or hot lemon juice in order to get rapid absorption. Subsequent doses starting two hours later and continuing at four-hourly intervals for four days, should be 0·5 gramme as an uncrushed tablet in order to delay absorption. Dosage: first day 4·5 grammes; subsequent days 3 grammes: total 13·5 grammes.

*Local application*: 5 to 15 grammes of sulphonamide or sulphapyridine may be packed into the wound at the time of débridement or the drug may be blown into the wound by an insufflator with the object of exerting a bacterioscopic effect. Local application should be used sparingly in the case of wounds involving the brain as these chemicals have been found to act as foreign bodies in contact with nerve tissue.

Treatment of gas gangrene by surgical means has already been given. In addition to surgery, Henderson and Gorer have shown that the best available treatment for the established disease is probably a combination of antitoxin and of chemotherapy with sulphonamide or sulphapyridine.

The therapeutic dosage of polyvalent antitoxin is as follows: 7,500 international units *Cl. welchii* antitoxin, 3,750 international units *Cl. septique* antitoxin and 2,500 international units *Cl. œdematiens* antitoxin, given intravenously and repeated as necessary while symptoms of toxæmia persist.

The therapeutic dose of sulphonamide or sulphapyridine should be: First dose 2 grammes dissolved in hot citric acid or hot lemon, subsequent doses after two hours and at four-hourly intervals for two days 1 gramme uncrushed. After the first two days the dosage should be gradually reduced as the clinical condition improves. Small doses, 3 grammes per diem, should be continued after the temperature has become normal and the clinical condition satisfactory. The total dosage should seldom exceed 35 grammes.

In cases where the surgeon has to operate on wounds already infected

with anaerobic microbes pre-operative administration of sulphonamide or sulphapyridine by the mouth and of antitoxin intravenously may prevent the spread of infection. The dose of the drug should be 3 grammes given two hours before the operation.

The memorandum concludes with a suggested scheme drawn up by the London Sector Pathologists for the bacteriological investigation of war wounds, with a brief description of the collection of specimens and the methods of identification of the common pathogenic bacteria in war wounds—streptococci, staphylococci, and the gas gangrene anaerobes.

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### PREVENTION OF TETANUS.

IN the January number of the *Journal*, we wrote an Editorial on the prevention of tetanus. We gave some figures for the incidence of tetanus during the war 1914-18, taken from papers by Sir David Bruce, Sir William Leishman, and Colonel S. L. Cummins. The rapid fall in the incidence of tetanus after the issue of anti-tetanus serum is shown by the figures given by Cummins. In August, 1914, the ratio per 1,000 of cases of tetanus to total wounded was 8·5; in September, 8·8; in October, 7·4; in November, 3·0; and in December, 1·5. The issue of serum on an adequate scale was made in October and November. In former wars the case mortality was 85 per cent. In 1914-18 there were 1,254 deaths in the total of 2,529 cases, amounting to nearly 50 per cent; this is probably an over-statement as regards tetanus, as many of the deaths were due to wounds. In order to get an idea of the real fall in mortality Cummins analysed the figures on the Western front and sorted them into two-yearly periods. In 1914-15 the case mortality was 63·5 per cent; in 1916-17, 45·2 per cent; in 1918-19, 37·9 per cent. In 1936 the Director of Pathology pointed out that the supplies of serum were insufficient at the outset of the last war and forward arrangements should be made to obtain a satisfactory supply. Contracts were placed with the Serum Institute for supplies of antitoxin for the field units in the case of a major war. As four to six months are required to produce a satisfactory serum in a horse, arrangements were made with the Army Veterinary Service to pre-immunize horses, and from 1936 onwards, for three years, 30 horses were available. On the outbreak of war 14 horses were handed over to the Wellcome Serum Institute and 16 to the Lister Institute, Elstree.

While prophylactic anti-tetanus serum accomplished much, it did not give absolute protection against tetanus; there were also the disadvantages of serum sickness and serum shock from the repeated injections of foreign protein.

Recent years have seen the introduction of active immunization by the use of formol-toxoid. In 1924 Ramon found that toxin if treated

with low concentrations of formalin and kept at a temperature of 37° C. for a month lost its toxic action but retained its antigenic properties. This altered toxin was called anatoxin by Ramon, but is now generally known as toxoid. The results of experiments on man were published by Ramon and Zoeller in 1927. They gave three injections, the first 1 c.c., the second a month later of 1.5 c.c., and the third ten to fifteen days later of 1.5 c.c. With this method they claim to obtain a titre of from 0.1 to 1 unit of antitoxin per c.c. of serum. This three-dose system of giving formol-toxoid has been followed by most workers on the Continent and in America and Canada.

At a meeting of the Army Pathological Committee the Director of Pathology raised the question of active immunization as a routine measure for the British Army. As a result investigations were undertaken at the Royal Army Medical College in collaboration with Dr. O'Brien at the Wellcome Research Laboratory. The results of these investigations, especially those of Major J. M. Boyd, were so successful that active immunization against tetanus was introduced into the Army in 1938. An Army Council Instruction was issued in 1938, which stated that inoculation consists of two injections given at intervals of six weeks. It is not necessary to repeat the injections as protection lasts for many years. The inoculation was voluntary and officers were asked to bring it to the notice of all ranks. Some 70 per cent of the men of the Regular Army availed themselves of this means of protection.

The French recommend an immediate injection of toxoid for the freshly wounded, but immunized soldier. If the man has not been previously immunized he should receive 1 c.c. of tetanus toxoid followed by 3,000 units of anti-tetanus serum and then at fifteen days' interval two further injections of toxoid. In the British Army immediate administration of 3,000 units is required to be given at the earliest possible moment.

An annotation in the *British Medical Journal* of August 10, 1940, drew attention to the possibility of assessing the value of new methods of treating casualties and referred to the fact that there ought to be available at the present time information regarding the incidence of tetanus in such cases as have occurred. In response, the Director of Pathology (Major-General H. Marrian Perry) writes that "in the present war the prophylaxis of tetanus differs in one important respect from the measures adopted in 1914-18, in that active immunization by means of tetanus toxoid is employed. Approximately 80 per cent of the whole of the British Expeditionary Force was protected by this means." . . . "Full reliance is not, however, placed on active immunization owing to the possibility of an indifferent individual response, and also because 20 per cent of the Force had not been inoculated. For the above reasons the policy has been adopted that every casualty should receive as soon as possible after the infliction of the wound 3,000 international units of tetanus antitoxin, irrespective of prior immunization. In the circumstances that arose in the recent campaign in France and Flan-

ders, it is evident that it was not possible in the majority of cases to administer this prophylactic antitoxin, although adequate supplies were available. The position was indeed comparable to the opening phases of the 1914-18 war, when tetanus antitoxin was not available in sufficient quantities, or could not be administered owing to the military situation. Prevention of tetanus in recent casualties was therefore dependent upon the degree of immunity conferred by the tetanus toxoid."

"On the outbreak of war Army Forms for reporting cases of tetanus were distributed to all military hospitals, both at home and abroad, as well as to the Emergency Service Hospitals in this country receiving convoys. These reports have now been rendered and it is possible to give the approximate incidence of the disease compared with the first three months of the war of 1914-18, when the incidence was about 8 per 1,000 wounded; the figure in the present war is 0.45 per 1,000. It is significant that such cases as have been noted have occurred in individuals who have not been actively immunized. Among casualties of the British Expeditionary Force, there has been no reported instance of tetanus in soldiers protected by means of tetanus toxoid. It is only fair to remark that a number of wounded received prophylactic doses of antitoxin subsequent to their arrival in this country—that is to say two or three days after the infliction of the wound."

In view of General Perry's statements, especially that no case of tetanus has been reported in wounded actively immunized by tetanus toxoid, a leading article in the *Lancet* of October 12 states that it is an obvious duty to extend active immunization to as many as possible of those who are, or are likely to be, in the front line at home. Among these are specially noted ambulance units, the fire brigades and the A.R.P. demolition squads, who have been carrying on so magnificently their rescue work in our bombed towns and cities. The responsibility for their protection rests with hospitals and public health authorities, and it is stated that already a certain amount of active immunization has been done amongst them. The Leader also suggests that "another large body of men who may at any time be in the 'front line' is the Home Guard, and after setting such a fine example to the regular Army the War Office might well take in hand the immunization of our country's second line of defence."

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## Clinical and other Notes.

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### TWO CASES OF OSTEOCHONDRITIS DISSECANS.

BY LIEUTENANT-COLONEL J. C. ANDERSON,

*Royal Army Medical Corps.*

THE first of these cases was dealt with by me when I was Surgical Specialist at Shorncliffe Military Hospital. The second case came under my observation two months after it had been operated upon by Major Dudley Jones at the Military Hospital, Ormskirk.

The first patient was a young soldier aged 19. Two years previously, whilst playing football, the scrum collapsed upon him and he got a sharp



FIG. 1.

stab of pain in his right knee. He limped for the rest of the game, but was all right after that. He did not remember any swelling of the joint. Subsequently "it always bothered him slightly," but he did not think anything of it; for example, in the gymnasium at school it used to pull him up, he could not sit back on his heels and still could not do so, and when he tried the knee seemed to lock and he could not go any further. He continued to play Rugby football, ran in the middle distances, and participated in competitive swimming.

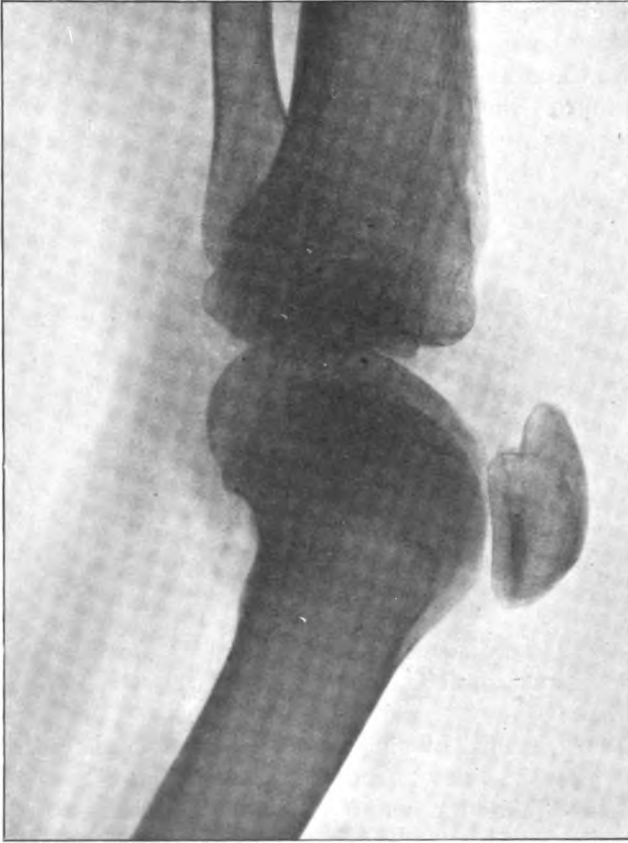


FIG. 2.

In January, 1940, there was a new development, when walking the leg would just go away from him and leave him standing on one leg; he might stumble. He would experience sudden severe pain in the knee for a time; this would "numb it up." He could not localize the pain which appeared to be in the centre of the joint.

The man was tall and slim and of quite good physical development. He was being trained as a physical training instructor. His symptoms

were referred to the right knee-joint and, as I have already remarked, he could not localize the pain beyond saying that it appeared to be in the centre of the joint. There was no point of tenderness, no effusion, and no muscular wasting. Flexion of the joint was limited by about 10 degrees. Extension was full but when the knee reached a point within 10 degrees of full extension a peculiar jerk was experienced in the joint. An X-ray examination revealed an apparently loose fragment of bone about the size of a bean, which appeared to lie free within a shallow depression on the medial condyle of the right femur at the junction of the vertical and horizontal surfaces of this condyle. Two X-ray films are reproduced.

I diagnosed a condition of osteochondritis dissecans. From his history I deduced that the disease had been in progress for two years and that two months previously the bone fragment had separated from the surrounding bone, that it was now loose or almost completely loose, and that this mobility accounted for his severe attacks of pain.

At the operation on February 5, 1940, I was surprised to find that the fragment was not loose. It was clearly demarcated by a shallow groove, but the articular cartilage was quite intact. I could find no line of cleavage between the "loose fragment," and the rest of the bone. When pressed upon, the affected area appeared to yield a little. I closed the joint without further interference and decided to immobilize the limb in plaster of Paris for a period of two months.

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### CONTUSION OF THE LUNG FOLLOWING AN INJURY.

BY MAJOR P. F. PALMER,

*Royal Army Medical Corps.*

PRIVATE T., 2nd Suffolk Regiment, aged 25, total service  $5\frac{1}{2}$  years. India  $3\frac{1}{2}$  years, was admitted to hospital on July 21, 1938, and gave the following history :—

July 10, 1938 : Whilst playing football he was struck on the right chest with the ball. He was not knocked down but the blow started a cough which lasted throughout the game. This passed off and he remained quite fit doing normal duties during the following week. Five days later he reported sick with pain under the right breast. He stated that pain was present all the time, was stabbing in character, and not affected by taking a deep breath. Four days after this, whilst doing guard duty, he started to cough up yellowish blood-stained sputum, and was admitted to hospital.

*Past History.*—Double pneumonia, aged 5, fit at school ; no rheumatic diseases, and fit since.

*Family History.*—Good stock.

*General Condition.*—He states his appetite is fair ; he sleeps well ; now and then suffers with headache ; has never had any previous chest trouble.

is not breathless, appetite and digestion good, bowels regular; cigarettes forty a day, feels fit and keeping his weight.

July 21: Admitted to hospital; temperature  $101.2^{\circ}$  F., pulse 96. Cough with sputum as stated above. During the night the cough was troublesome and caused faecal incontinence. He was perspiring freely and was said to have vomited dark red blood. The case was seen by the assistant surgeon on duty, who ordered morphia  $\frac{1}{6}$  gr.

July 22: When seen by me his condition was as follows: Patient appeared quite comfortable. There was no distress of any kind. There was marked clubbing of the fingers and toes. Movement of the chest was full and equal. Vocal fremitus was equal on both sides. Percussion revealed a normal note. On auscultation there was a slight increase in vocal resonance in the



FIG. 1.

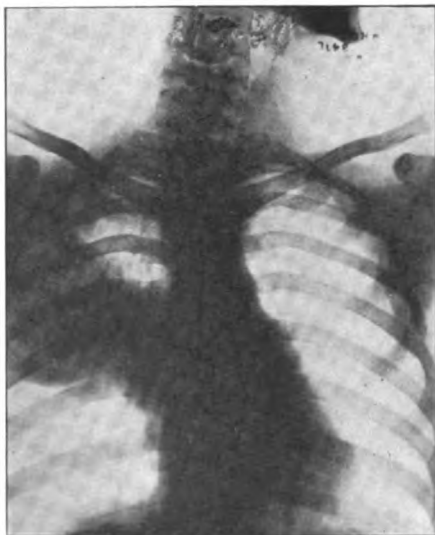


FIG. 2.

fifth space on the right side in the mid-clavicular line, and a few crepitations were heard at the end of inspiration over the same area. Air entry was somewhat diminished at the right base behind. The apex beat appeared to be in the fourth space four inches from the mid-line. Sounds were clear, pulse was good. Sputum was greyish, blood-streaked, and nummular, somewhat like the sputum seen in a previous case of collapse of the lung. Laboratory examination of the sputum revealed the presence of pneumococci, streptococci, and staphylococci. Temperature was  $100^{\circ}$  F., pulse 88. Respirations were not charted, so were probably normal. The patient's appearance did not suggest pneumonia.

In view of the history of an injury the chest was X-rayed and revealed an irregular opacity involving the base of the upper right lobe, fig. 1.

July 23 : Six ounces of greyish, non-offensive, non-viscid sputum have been coughed up since the previous day. There was herpes on the upper lip ; temperature 99° F., pulse 80, respirations 18. Patient still looks comfortable. On auscultation a roughish sound was heard at the end of inspiration over affected area, which may have been pleural in origin.

July 24 : Swinging temperature 100·8° to 102·8° F., pulse 78 to 88 throughout the day. Free purulent expectorations of which a few were rusty.

July 25 : Swinging temperature 100° to 103° F. Complains of pain in the right chest. There is a pleuritic rub over the third space in front with diminished air entry over the base of the upper lobe in front. Expectoration continued, but was not rusty.

July 28 : Patient still looks comfortable ; running irregular fever. There are no sweats ; sputum still purulent, about four ounces. Over the base of the upper lobe in front there is slight dullness. Air entry is poor. Case does not suggest a frank pneumonia either from the patient's appearance or from the physical signs.

July 29 : X-ray shows signs of resolution in the opacity, fig. 2.

July 31 : Patient complained of a restless night. There are small blood-clots in the sputum ; physical signs about the same. Sputum examined as on previous occasions for T.B. but none found.

Blood examination : R.B.C. 5,000,000 ; Hb. 65 per cent ; W.B.C. 11,400 ; polymorphs 75 per cent.

August 5 : Swinging temperature still present, pulse a little bit faster than it was.

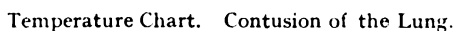
General condition : General condition the same ; sputum somewhat less. air entry returning over the upper lobe. X-ray repeated and the report suggests an abscess ; of this clinically there is no evidence.

August 13 : Temperature gradually falling, varying from 100° F. to normal ; pulse about 88 ; sputum somewhat less ; air entry much better. Further X-ray : the report states that there appears to be a thick layer of fibrous tissue replacing the interlobar pleura with radiating fibrous bands. Opacity is more homogeneous.

August 15 : Temperature almost normal. Exploratory puncture did not reveal fluid. During the next few days temperature rose on two occasions to 103·6° and 101·4° F. with further pain in the right chest. This was associated with a great decrease in the amount of sputum and the temperature later fell on free expectoration again ensuing.

In view of the history of past pneumonia and the clubbing of the fingers and toes, bronchiectasis was considered as the source of the sputum, but this appeared unlikely unless it was of the latent type, since the patient strenuously denied chest trouble of any kind.

The question of the cause for this clubbing was now considered, and I requested the patient to be so good as to write to his family doctor and ask



him about clubbed fingers in the rest of the family. His family doctor wrote to me the following note :—

“ The patient’s father has clubbed fingers but has never had any chronic chest or heart complaint. The condition is probably hereditary.”

August 23 : Temperature has now settled ; sputum less than an ounce in twelve hours. Further X-ray shows the shadow to be less, fig. 3.

August 29 : Case is continuing afebrile. To-day there was increase of sputum to about two ounces, which contained altered blood. Air entry is good and for the first time there are moist sounds to be heard over the affected area.

September 5 : Case continues afebrile ; no physical signs in the chest ; X-ray shows the shadow to be clearing, fig. 4. The patient was discharged to duty on September 7.

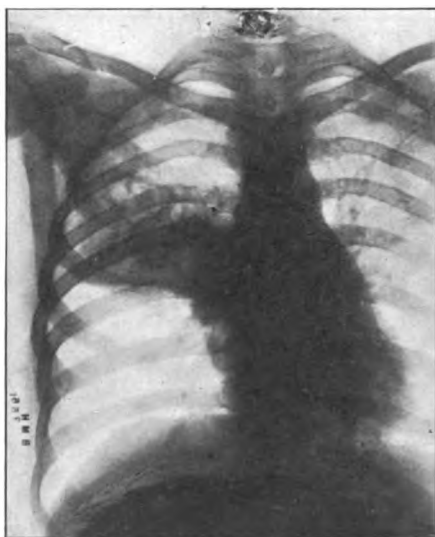


FIG. 3.



FIG. 4.

April 8, 1939 : There is small residual opacity at the site of the previous lesion.

The case is of interest inasmuch as the actual disease was never clear. Following a blow on the chest a perfectly fit soldier began to complain of pain and copious purulent sputum and for a month ran an irregular fever, at first swinging in type. Throughout, physical signs were very indefinite. The only constant sign was diminished air entry and free expectoration, and not till a few days before his discharge from hospital did moist sounds appear over the affected area, associated with an increase in sputum which contained altered blood. An outstanding feature throughout the disease was the patient’s apparent comfort. He neither looked nor felt ill. Physical signs

did not suggest a frank pneumonia, though labial herpes did occur at the onset. Respirations throughout were only slightly increased. The question of bronchiectasis was raised and dismissed. Condition was not due to fluid in the chest since exploratory puncture was negative. Diagnosis of lung abscess did not appear to fit the case either. The probable aetiology which is consistent with the findings appears to be as follows :—

The blow on the chest caused a local lung injury and was in the nature of a contusion with some hæmorrhage, which accounts for blood coughed up at the beginning of the illness. Surrounding this contusion was an area of collapse, the signs of which were disguised by overlying healthy lung. In this area there was probably a resultant pyogenic infection as shown by the organisms in the sputum. It is reasonable to suppose that the bronchus to this area was blocked and that the compression of the surrounding healthy lung milked this area and sputum was therefore coughed up. This appears to be logical since no moist sounds were heard, and therefore air was not passing into the damaged area. The bronchus cleared from the top and when air once again passed into the lung tissue through the now patent bronchus, moist sounds were heard and the site of the original injury was rapidly cleared of secretion, as shown by the increase in sputum which contained altered blood on the last day of the illness, after which sputum ceased altogether.

*Treatment.*—The only treatment given was generous diet and ammon. carb. and creosote mixture. The slowly falling temperature and the decrease in sputum indicated that the condition was improving, though there was little change in serial radiographs.

It is regretted that radiographs of August 23 and September 5 are not available as the originals were lost in the post.

*Conclusion.*—A case of a lung lesion following an injury is described.

Serial radiographs are shown.

The lesion in the lung has now completely disappeared.

Stereoscopic radiographs showed the lesion to be deep in the lung.

Lieutenant-Colonel E. P. Allman Smith, Commanding British Military Hospital, Mhow, has given permission for these notes to be sent for publication.



**MASSIVE COLLAPSE OF THE LUNG.**

BY MAJOR P. F. PALMER,  
*Royal Army Medical Corps.*

THIS article was published in the July number of the Journal. The correct figures illustrating the article are now produced.

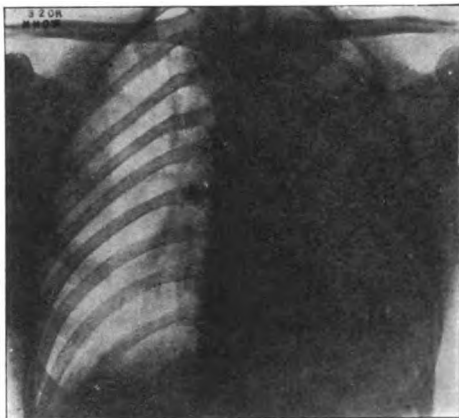


FIG. 1.

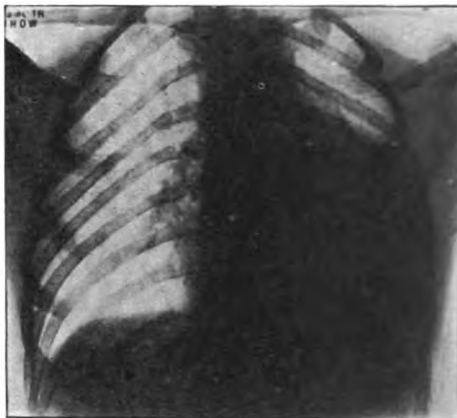


FIG. 2.

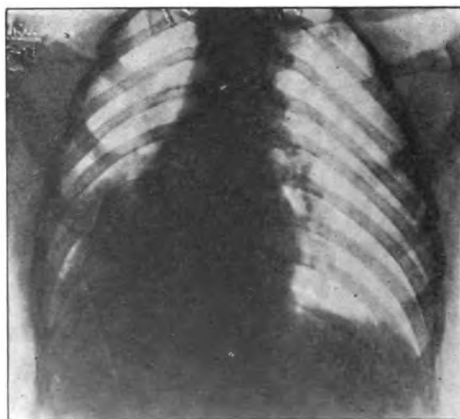


FIG. 3.

## Current Literature.

OGILVIE, W. H. War Wounds of the Abdomen. *Lancet*, August 31, 1940.

In the *Lancet* of August 31, W. H. Ogilvie, Surgeon to Guy's Hospital, writes: "The late complications likely to be met with in war wounds of the abdomen are 'burst abdomens' and still later ventral herniæ, residual abscesses, retained foreign bodies, fæcal fistulas and intestinal obstruction." These differ from peace time in that the abdominal parietes are damaged as well as incised. There are usually wounds of entry and exit as well as the incision for laparotomy. In a war-wound the amount of adhesions in an early phase of repair, and of scar tissue in the later ones, are greatly in excess of anything met in civil practice. The patient has probably been previously operated upon by another surgeon and details of treatment are lacking.

The best times to operate are very early or very late—before six hours and after six weeks. If any operation is undertaken after six hours the softened tissues tear and bleed, normal planes are obliterated so it is easy to go astray and bacteria are let through the defences into unprepared tissues. Later when the bacteria have been overcome the whole defence zone settles down to its normal appearance and structure. Scar tissue becomes avascular and is limited to the amount required to repair defects. In the abdomen adhesions disappear or remain as bands around the area of damage. The surgeon can find healthy tissues close to the injured areas and is able to cut through relatively uninfected scar tissue with little bleeding.

Ogilvie states that while many people would call this a plaster war, it will be truer in the end to call it a vaseline war. The more we use vaseline the more we trust it and the wider do we find its uses.

The problem of a defect in the abdominal wall may present itself at any stage. Since posture can be used to aid approximation, it is usually possible to close a gap up to three inches by direct suture. When the gap exceeds three inches closure by direct suture is impossible, for healing skin is required; sliding flaps have been advocated, but Ogilvie has not found them of much service. Voluntary muscle is not a particularly viable tissue, and often sloughs, and if skin only is used the deeper layers will retract and leave an enormous defect difficult to deal with later. He has used a double sheet of light canvas or stout cotton cloth sterilized in vaseline; this is cut rather smaller than the defect in the muscles and sutured into place with interrupted catgut sutures. At one corner a small strip of vaseline gauze enters the abdomen as a drain. This device preventing retraction of the edges of the gap, keeps the intestinal contents from protruding and allows the abdominal wall as a whole to be used in respiration. When the sutures come out the edges of the defect and the surface of the viscera are covered with granulations and the gap is much smaller and not

liable to explosive enlargement. If a sutured wound gives way three weeks after treatment it may be closed with deep sutures through the tissues when this can be done without undue tension, otherwise the stitches will tear out and increase the defect. Here the chief need is to prevent evisceration. Ogilvie advises that gauze swabs sterilized in and impregnated with vaseline should be laid over the exposed viscera, their edges tucked well under those of the defect, the sides of the incision are then brought together with strips of elastoplast. Vaseline gauze makes an excellent peritoneum. the coils of gut move under it, and it need not be removed for weeks, till wound edges and contents are fused in an oval of granulation tissue. On this surface pineal grafts are sprinkled and healing takes place rapidly.

Ventral herniæ present another problem and Ogilvie states they may be regarded with resignation as a token that the patient has lived long enough to develop the defect. A large gap is no danger as strangulation is not liable to occur. Such cases are better treated with a belt. For practical purposes if the edges cannot be brought within two inches of each other by pressure on the sides when the patient lies on his back with his knees raised, the idea of operation should be abandoned.

Residual abscesses nearly always settle themselves by finding their way to the original incision and evacuate their pus on to the surface or by opening into a hollow viscus. Only at the subdiaphragmatic space or pelvis is interference likely to be required. In drainage of abdominal abscesses Ogilvie considers vaseline gauze is better than anything we have known before : it draws the whole of the abscess cavity whatever its size, shape or ramifications and it is harmless under all conditions.

The treatment of foreign bodies retained in the abdomen presents itself in infinite variety. All large foreign bodies lying free in the abdominal cavity will have been removed at the previous operation. The foreign bodies are either small, or lying in the solid viscera, the abdominal parietes, or in soft parts adjacent to the abdomen. Small foreign bodies are likely to find their way, either by ulcerating into some part of the alimentary canal and being passed, or by being discharged along a sinus. It is not absolutely necessary to remove a foreign body unless it is lying in close proximity to a large vessel or responsible for a persistent faecal or urinary leak that cannot be stopped without its removal.

Ogilvie considers that a faecal fistula, from the large or small intestine, is doing no harm unless it is leading to loss of nourishment and dehydration ; these do not become serious problems unless the fistula is above the lower third of the ileum and not even then unless it diverts a considerable amount of the intestinal contents to the surface. When the patient is not losing ground waiting can do nothing but good. The fistula may close spontaneously and should do so if there is no obstruction distal to the abnormal opening. When it is decided that an operation is necessary the fullest information should be obtained by barium meal or enema, or by barium injected into the fistula at the site of the affected loop, its level in the ali-

mentary canal, the calibre of the bowel distal to it and the length and diameter of the track by which it communicates with the surface.

The recognition of intestinal obstruction is always difficult, and in the abdomen which has suffered a war wound there are countless opportunities for obstruction; apertures, bands, loops and adhesions are probable in any war-wounded abdomen and laparotomy cannot be advised with the same readiness as in civil surgery. We have to distinguish between remediable obstruction that will clear up with measures to empty and rest the bowel and irreducible obstruction that requires immediate operation for its relief. The first is the result of ileus due to mild plastic peritonitis, or to recent handling—causing partial mechanical block, a series of adhesions or a single sharp kink, that has been rendered complete by ileus or by gaseous distension of the involved coils. Such conditions are aggravated by laparotomy. If the obstruction can be relieved by non-operative means adhesions will not remain as permanent dangers. If time is allowed the abdomen will soften adhesions, straighten kinks and in the end produce an arrangement which will work. The causes in the irreducible group cannot be recognized with certainty, but the discovery of local swelling and local tenderness will suggest their presence. The chief aim of the modern treatment of ileus is to rest the bowel—and also to assist peristalsis and neutralized toxins nothing must be given by the mouth, except an occasional rinse, or better, chewing pineapple squares, spitting out the fibres to keep the salivary glands in working order. The bowel must be erupted above and below. A Ryle tube is passed through the nostril and the stomach emptied by aspiration. In desperate cases with much toxic absorption the Miller-Abbott double-lumen tube is a great advance on the Ryle tube, for when the stomach is emptied it can be allowed to pass into the duodenum and is then carried by peristalsis down the intestine emptying the distended coils as it goes until the ileus is overcome. The large intestine is emptied by enemata of six ounces of equal parts ox bile and water which only reach the pelvi-rectal. They should be repeated every twelve hours. The supply of fluids, water and nourishment must be given otherwise. The intravenous drip supplies these needs or the intramuscular drip introduced by the Postgraduate School may replace it. From the point of view of fluid balance we should aim at an input of 40 drops a minute and six pints a day, and an output of 50 ounces of urine. The fluids must be isotonic and we should avoid glucose in saline which is hypertonic and rapidly damages the endothelium of the vein leading to thrombosis. One drachm of salt is enough for a sick man: therefore one pint of saline should be the standard ration, the other five pints being 5 per cent glucose in distilled water. For the first few days every pint of fluid vomited or withdrawn by suction calls for a pint of saline in addition to the daily ration. When vomiting ceases the ratio of one of saline to five of glucose water should be resumed.

Morphia may constipate a normal person, but according to Plaut and Miller in ileus it increases the tone of the intestinal muscles. When the

question of laparotomy is still in abeyance the amount should be confined to one grain per day, but in post-operative ileus that dose may be doubled. The administration of prostigmine or acetylcholine in Ogilvie's experience has proved useless if not harmful. Pitressin seems less objectionable and can be given continuously in the intravenous solutions without harm and apparent benefit. In operation after a war injury the original incision is best left alone and the approach made through a fresh one. In relieving obstruction it is best to do as little as possible and keep away from resection if it can be safely avoided. Ogilvie states that he learned from Norman Dott that in emergency resection of the small intestine one row of interrupted stitches is better than two continuous layers—quicker, safer, and less liable to diaphragm formation from œdema.

**LERICHE, R., and WERQUINI, H. G. Effects of Arterial Ligature on the Vasomotor System.**

The usual method of treating arterial wounds is by direct ligature. The authors state that the morbid changes which take place in the limb are due partly to sudden interruption of the blood supply in the main vessel and partly to the stimulation of the nervous plexus situated in the arterial wall at the points of bifurcation and at the origins of collaterals thus producing a reflex vasoconstriction in the collateral circulation. This vasoconstriction is removed by resection of the obliterated length of the affected artery; the limb becomes warmer, the colour returns, the movements are stronger and even the pulse may return. The tonic action is controlled by the regional sympathetic plexus; the vaso-constriction will disappear when the sympathetic plexus is either resected or anæsthetized. The authors state that the vasoconstriction reflex can be abolished by arterial section between ligatures, by periarterial sympathectomy above the lesion, by anæsthetic infiltration of the adventitious coat, by regional infiltration of the sympathetic system, or by section and ganglionectomy.

The restoration of the circulation in a limb after tying a main artery is assured if the collaterals are sufficient in number and if they open up rapidly. It is to the collaterals running in the muscles that Leriche and Werquini attribute the establishment of the circulation, and their destruction may mean that blood no longer has a pathway back to the main vessel below its damaged section. Ischæmic gangrene should no longer be inevitable and the risk attendant on arterial ligature should be much lessened.

Failure in the re-establishment in a limb may also be contributed to by lowering of the general blood-pressure by hæmorrhage or shock. A blood loss of 1,000 c.c. is common in war wounds and causes such hypotension that ischæmia is just about fatal. Blood transfusion will counteract anæmia, but may not restore the constricted peripheral circulation.

The sequelæ of ligature are massive gangrene, partial gangrene, ischæmic sclerosis and claudication.

Massive gangrene (ischæmic, not gas gangrene) is the most serious of the effects of ligature. The collateral circulation does not suffice to keep alive the part that ligature of the artery has suddenly rendered anæmic. Secondary thrombosis through sepsis in muscle or connective tissue may interrupt a partially restored circulation. The effects of ischæmia appear gradually, after about a quarter of an hour the digits become numb, then feeling of touch, heat and cold, disappears. After 20-25 minutes anæsthesia with analgesia is established and creeps up the forearm and leg. About the same time progressive muscular paresis develops in the hand, affecting first the thenar and interosseus muscles, next the flexors and last of all the extensors. In an hour immobility is complete up to the elbow or to the knee. After three-quarters of an hour if the circulation is not restored, recovery is no longer possible or is only partial and gangrene sets in. The level of the obliteration determines the extent of the change. Moist gangrene appears to be due to the spread of the thrombosis to the veins rather than to infection of the part. When the circulation is restored within the time limit indicated, there may be no anatomical lesions and recovery may be complete. Often it is incomplete and local necrosis may remain.

In some cases in which local necrosis is averted the circulation in the ligatured artery remains less than normal and dense secondary sclerosis develops affecting muscles, nerves and vessels. This condition is sometimes called "ischæmic paralysis."

In less serious cases where circulation appears to be efficiently restored, intermittent claudication, stiffness or muscular paresis may develop.

The best prophylaxis would be the substitution of suture for ligature, but this is generally impossible in war wounds. The next best thing is limited resection of the artery between two ligatures; the blood-pressure being maintained to aid the rapid flow of the blood back into the limb. Periarterial sympathectomy above the ligature is also useful as is infiltration or section of the regional sympathetic plexus. If infiltration is to be done, it should be done at once. Delay is fatal because the tissues die quickly. Infiltration of the cervical or lumbar sympathetic is more necessary than warming the patient with cotton-wool or with radiant heat. It is not the skin that wants the warmth so much as the deeper tissues. Infiltration must be repeated as often as necessary. We can do nothing for dead tissues. The ideal treatment would be resection of the ligated and thrombosed segment of the artery followed by grafting to restore arterial continuity.

STOCKS, P. **The First Seven Months : a Study of War-Time Mortality in London.** *Lancet*, 1940. April 20, 725-9, 1 diagram.

LANCET. 1940. April 20, 745-6. **London's War-Time Mortality.**

This very valuable paper has been constructed in the following way. For the County of London records of deaths at ages and from a number of causes are compiled weekly, so that for this fraction of the people, about 10 per cent, one can study changes in mortality rates at once. At the present

time, war measures have led to a redistribution of the population, but it is practicable for the staff of the General Register Office to allow for this and so to compare the deaths registered in London with those which would have occurred had the rates of 1938-39 in corresponding weeks been applicable.

Dr. Stocks has made a systematic comparison with the following results.

At ages under five there has been a substantial saving of life. This has been due to a decline of mortality from pneumonia, bronchitis, diarrhoea and whooping-cough as well as the failure of the expected epidemic of measles to emerge (Liverpool and Manchester also record an absence of measles).

Children of school age did not benefit so much, but there were very few deaths from diphtheria, measles and whooping-cough. Young adults had increased mortality in the winter mainly from respiratory tuberculosis, bronchitis, respiratory diseases other than pneumonia and heart disease. But their deaths from pneumonia did not increase.

Adults over 45 years had a substantial increase in mortality during the cold months of January and February, mainly due to respiratory and heart diseases, but the proportionate increase in pneumonia was much less than for influenza, bronchitis and other respiratory diseases.

These results lead to important epidemiological conclusions. Since the advantage of the young children is the most pronounced, and the failure of measles to assume epidemic proportions in several areas where it was expected can hardly be a mere coincidence, it follows that the school closure, however undesirable on other grounds, had a favourable epidemiological effect. The children of school age indeed did not benefit much, but their younger brothers and sisters did. The tale of the mortality at older ages is less gratifying, but we can hardly attribute the appearance of a moderately severe epidemic of influenza to war conditions. Indeed, having regard to weather conditions, we may be glad to have escaped so lightly (perhaps here the lessened resort to cinemas and other places of entertainment may have had a part). It is noteworthy, having regard to therapeutic advances, that pneumonia has been less deadly than usual. Dr. Stocks also provides a table showing that the excess of traffic fatalities was much greater in moonless weeks than in weeks when the moon was full. This has a certain grim interest (particularly when we remember that the moon at full was sometimes obscured) and recalls the attention our ancestors paid to the choice of nights for visiting friends.

M. GREENWOOD.

*Reprinted from "Bulletin of Hygiene," Vol. 15, No.7.*

POLDING, J. B. *Brucella melitensis* Infection in the Maltese Goat. *J. Amer. Vet. M. Ass.* 1940, v. 96, 30-35.

There is a popular conception that the Maltese goat is sufficiently resistant to *Brucella melitensis* infection to withstand a systemic disturbance but it is pointed out that this is not so, and that this animal may suffer an acute disease. The mature pregnant goat shows evidence of the invasion

of the organism after subcutaneous injection of *Br. melitensis* and a bacteræmia exists from about the end of the first week for about a month. In non-pregnant goats there is either no bacteræmia or one which is short lived. Clinical symptoms other than abortion exist in acutely infected goats. There are pyrexia, loss of condition, probably a slight diarrhœa and, in lactating goats, the milk changes to a clear fluid with a suspension of clots containing *Br. melitensis*. The infection appears to localize about the second month after the termination of the pregnancy during which the infection took place; the udder and uterus often appear to be excluded from infection by about the fifth month but the glands draining the genital areas may remain infected for years.

Kids appear to be resistant for about the first two months of life and in slightly older animals a transient infection occurs; the critical age after which, when infection is great, there is prolonged infection, is five and a half months.

R. LOVELL.

*Reprinted from "Bulletin of Hygiene," Vol. 15, No. 7.*

HADFIELD, G., SWAIN, R. H. A., ROSS, J. M., DRURY-WHITE, J. M. **Blast from High Explosive.** *Lancet*, October 19, 1940.

The authors have issued a preliminary report on ten fatal cases following exposure to blast. Ten civilians died suddenly, or in a few hours after short-range exposure to the detonation of high explosive during actual bombardment. The evidence pointed to death being due to "blast." In all but one case gross traumatic lesions were either completely absent or of trivial degree. Five of the cases were believed to have died from the effects of "blast," intra-pulmonary capillary hæmorrhage being the only gross anatomical lesion common to them all. In three cases considered to be cases of blast, further investigation showed that in addition to the lung lesion, each had such a degree of saturation of the blood with carbon monoxide as to leave no doubt that carbon-monoxide poisoning was the cause of death. Two cases were extricated from overlying debris. They were uninjured, and at first were considered to have died from "blast," but further examination showed they had died from compression asphyxia.

In each of the ten cases some degree of capillary hæmorrhage into the lung was found. In the two in which death was considered to be due to compression asphyxia, the hæmorrhage was relatively slight, but the capillary and venous congestion and œdema present were striking, and the air passages contained only a small quantity of blood-stained fluid which was not frothy. In four cases in which death was supposed to be due entirely to the effects of blast there was free capillary bleeding over large areas, in which the respiratory bronchioles, atria and alveoli, showed uniform and considerable over-distension. It is not, however, quite clear that the hæmorrhage was due to rupture of the alveoli previously, and acutely dilated, for acute vesicular and interstitial emphysema was present in those parts of the lung which were free from hæmorrhage. Subpleural hæmorrhages were not common in those cases presumably due to blast. Hæmorrhage into the



walls of smaller bronchioles was occasionally found, but there was no bleeding into the air tubes larger than these. There was no suggestion that the hæmorrhages were grouped round the bronchial system. The microscopic subpleural bullæ appeared to be produced by the detachment of the visceral pleura and the subjacent elastic tissue from the underlying lung by air escaping from the ruptured alveoli.

The cases in which there was a grave degree of saturation of the blood with carbon monoxide showed pulmonary hæmorrhages of the same character as in those dying from blast alone. The most striking difference was the fresh pink colour of the hypostases in the carbon monoxide cases. In both groups the air passages contained much frothy serous fluid. The amount of blood extravasated into the lung varied considerably and it did not seem possible that the lung injury could fatally embarrass the respiration. The authors regard the lesion as a trustworthy indication that the patient has been struck at close range by a wave of high-pressure. It seemed likely that blast produces death by interfering with some vital tissue or centre in which from the extreme rapidity of action structural changes are unlikely to be found.

The estimation of carboxyhæmoglobin was made by Dr. Jordan in formol-fixed material, the proportion of blood pigment present as carboxyhæmoglobin was 50, 65 and 75 per cent.

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## Reviews.

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THE MEDICAL ANNUAL, 1940. Editors: H. Letheby Tidy, M.A., M.D. (Oxon), F.R.C.P., and A. Rendle Short, M.D., B.S., B.Sc., F.R.C.S. 1940. Pp. xlviii+604. Bristol: John Wright and Sons, Ltd. London: Simpkin Marshall, Ltd. Price 20s. net.

During these days of stress and strain, excursions and alarms, we are glad to welcome once again an old and honoured friend in that sturdy "evergreen," The Medical Annual for 1940."

This popular digest is, as usual, full of good fare but the war is still too young for the current number to have yet acquired the full war "flavour."

It is difficult to pick and choose where the general level is so high, but a few specially well-flavoured "Plats du jour" may be mentioned.

An excellent article on chemotherapy entirely devoted to a detailed description of the sulphonamide preparations is contributed by Dr. St. A. Heathcote. No mention is made of the new sulphanilamide derivatives sulphathiazol (M and B 760) and sulphamethylthiazol, but this is understandable as these drugs have only just commenced to attract attention on this side of the Atlantic, although acclaimed for some time past in certain American quarters as a panacea for all staphylococcal infections.

Group Captain A. F. Rook, R.A.F., in an interesting section dealing

with the medical aspects of flying discusses the many highly specialized problems involved from both the Services and civilian points of view.

Dr. H. L. Tidy and Mr. A. Rendle Short discuss the medical and surgical aspects of gastric and duodenal ulcer, and strange to relate, their respective points of view reveal no major clash nor do they mutually cancel out.

In an article dealing with oxygen therapy Mr. A. Tudor Edwards introduces us to (and illustrates) the new American B.L.B. mask, the efficiency and relative comfort of which can be fully vouched for by the reviewer.

A long and well-illustrated article on cystic disease of the lungs is contributed by Dr. Maurice Davidson.

In his review of recent work in connexion with epilepsy Dr. Macdonald Critchley mentions the new anti-convulsant preparation variously known as dilantin, epanutin, or solantoin, which, he thinks, can be used most usefully to supplement but not to replace such standard sedative preparations as phenobarbital.

Recent work on the chemotherapy of gonorrhœa is reviewed by Dr. T. Anwyl-Davies who emphasizes the importance of late chemo-therapeutic relapses many of which occur several months after tests of cure have been passed.

A short but instructive article from the pen of Mr. Geoffrey Jefferson deals with head injuries; paragraphs dealing with the diagnosis and treatment of middle meningeal hæmorrhage (which looms large in medical literature at the present time) and of subdural hæmatomas with their elusive symptomatology are of special interest.

Dr. Manson-Bahr in his review of malarial chemotherapy describes the new Bayer synthetic remedy, of the plasmoquine series, Certuna. He emphasizes the relative ineffectiveness of all known anti-malarial remedies against the sporozoite stage of the malarial parasite and mentions the hypothesis put forward by P. G. Shute, that there exists an intermediate stage of malaria parasite between the sporozoite and the young trophozoite (ring form).

Ascoli's method of treatment, which consists of increasing doses of adrenaline given with the idea of massaging parasites out of their lurking places in the backwaters of the spleen into the general peripheral circulation where they are susceptible to attack by quinine and other preparations, is also described.

The mental disturbances of war receive a short paragraph from the pen of Dr. Aubrey Lewis. As a result of extended and painful experience, doubtless this section will be expanded next year. He mentions a lecture delivered by H. A. Sandiford (Lieutenant-Colonel, R.A.M.C.) to officers of the R.A.M.C.; also a recent article by Professor Mira of Barcelona dealing with his experiences as chief psychiatrist to the republican army during the recent Spanish civil war.

The recent innovations, insulin and cardiazol, used in the treatment of schizophrenia, are fully dealt with by Dr. Aubrey Lewis.

A review of recent work in connexion with certain surgical diseases of the stomach by Rendle Short includes some excellent coloured illustrations of the gastropic appearances presented by certain of these diseases.

Macdonald Critchley contributes an article of considerable topical interest dealing with the medical hazards undergone by submarine crews; amongst other interesting items the dangers attending escape by means of the Davis submerged escape apparatus are fully dealt with.

In his short review of tetanus Mr. Lambert makes no further mention of active immunization by Ramon's tetanus toxoid, although this valuable prophylactic measure was discussed in last year's annual and that of 1938. This is a matter of great current interest and importance and one hopes for a full review next year.

The subject of X-ray diagnosis is, as usual, fully dealt with by Dr. Brailsford. A radiograph of a fractured femur showing the early development of gas-gangrene reminds me that this is no new discovery. In an article by H. E. Gamlen and S. Smith published in the *British Journal of Surgery* in 1917 and reproduced in "The Medical Annual" of 1918, there appears a radiograph of a gunshot wound of the skull, the main tracks leading to the retained missiles being clearly demarcated by large bubbles of gas due to the activities of gas-forming organisms within the brain.

I have only been able to skim the surface of this very excellent digest which deserves, nay demands, an honoured place on every up-to-date practitioner's bookshelf.

S. S.

CLINICAL PRACTICE IN INFECTIOUS DISEASES. By E. H. R. Harries, M.D. Lond., M.R.C.P., D.P.H., D.M.R.E., and M. Mitman, M.D. Lond., M.R.C.P., D.P.H., D.M.R.E. With a foreword by W. Allen Daley, M.D. Lond., F.R.C.P., D.P.H. Edinburgh: E. and S. Livingstone. 1940. Pp. xii+468. Price 17s. 6d.

An up-to-date clinical treatise on infectious diseases is always welcome, the more so as in this case the two authors are superintendents of large fever hospitals and can therefore speak with authority in the light of their extensive experience.

Little recent work of importance dealing with the range of diseases here discussed appears to have been omitted and a full and adequate description is given of the uses and limitations of sulphonamide therapy.

Adequate and up-to-date descriptions are given of certain diseases of special war-time interest and importance such as Weil's disease and the louse-borne infections, epidemic typhus, trench fever and relapsing fever, all of which must almost inevitably come into prominence before this war is over.

Most of the illustrations dealing with rashes are, partly from considerations of economy, partly for the sake of simplicity and greater clarity, restricted to simple line and colour drawings. It must be admitted that this method which indicates the distribution of the rash but gives little hint as to its nature, has its advantages—and disadvantages.

Dr. Allen Daley, in his foreword, rightly states that the work should appeal to a wide circle of readers, including the busy practitioner, students reading for their qualifying examinations (also for D.P.H.), fever hospital residents and M.O.H.s. To this list one might add all R.A.M.C. officers in attendance on troops, especially D.A.D.sH. and others whose special duty it is to wrestle with general problems of health as they affect the military population.

The authors are to be congratulated on having produced a book which is, on every score, to be recommended for perusal and retention by the large body of readers for whom it is intended. S. S.

ORGANIZATION, STRATEGY AND TACTICS OF THE ARMY MEDICAL SERVICES IN WAR. Second Edition. By Lieutenant-Colonel T. B. Nicholls, M.B., Ch.B., R.A.M.C. (Ret.). 1940. Pp. xvi + 496. London : Baillière, Tindall and Cox. Price 15s.

The second edition of the book on Army Medical Organization has now appeared. It contains just over 500 pages, an increase of about 100 pages, due to the inclusion of chapters on the Organization of Hospitals in E.M.S., Air Medical Transport and the Anti-Aircraft Medical Services.

At the present time, a large number of medical officers are undertaking, for the first time, duties as Commanding Officer. Many are engaged in learning the rudiments of their new military profession.

Those who have studied medical arrangements in the light of modern tactics, and have undergone practical experience of a warfare of rapid movement, ruthless attack and frequent air-raids, with dive-bombing and machine gunning, etc., have found that an almost entirely new scheme has to be devised. General policy has to be altered ; fresh details have to be worked out ; and no set and stereotyped plan can be relied upon.

It may be useful to follow accepted ideas and scheduled plans in certain circumstances. But at the present time, fluidity, elasticity and rapid improvisation are the key-notes of successful organization. The organizing officer, whether commanding a unit or administering a higher medical formation, must be up and about day and night during active operations, seeing everything for himself, helping-out in difficulties, arriving at instant decisions and taking appropriate action.

*Liaison, Camouflage and Conferences* are a few of the subjects, a knowledge of which is essential at the present time.

In making medical arrangements in mobile warfare, intercommunications and control are vital. A chapter could well have been devoted to this subject alone, including details of message-writing.

The subject of Operation Orders is well treated. But in war, medical departments of the staff should never issue operation orders. A very brief "medical para." for inclusion in Administrative instructions is all that is necessary in higher formations ; and in units such as Field Ambulances, or C.C.S.s, simple "instructions," or "medical arrangements," are all that is necessary.

Turning to the new chapter under "Air Transport," it will be observed that no mention is made either of the contra-indications for carrying surgical cases, or of the B.R.C.S. Air-Ambulance Organization which was commenced in 1931.

The chapter on Anti-Aircraft Medical Services is very brief, and that on the E.M.S. Services full and well written. The Army now collects casualties, hands them over to the Ministry of Health, and is informed that its responsibility ceases immediately the soldier crosses the threshold of the hospital.

The Army's *legal* responsibility may cease at this point, but its anxiety begins, because there is no further control, and many of the advanced hospitals are not organized for mass surgery. Liaison officers, however, have now been appointed, hence conditions may be improved. A magnificent piece of machinery has been built up: it only remains to be seen how it works.

Medical Military Organization cannot be learned from the book. In the Field, a small pocket-book, compiled by the officer himself, is the answer.

Colonel Nicholls' book is eminently an academic production, which should be found on the shelves of all libraries. E. M. C.

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## Notices.<sup>1</sup>

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### "HYPOLOID" DIGOXIN AND NORMAL SALINE.

DIGOXIN is a pure, stable, crystallized glucoside isolated from the leaves of *Digitalis lanata*; it was discovered and is prepared at the Wellcome Chemical Works, Dartford.

When giving "Hypoloid" Digoxin intravenously, it is necessary to dilute the solution immediately before administration with ten times the volume of sterile normal saline solution.

For the convenience of practitioners, Burroughs Wellcome and Co. now issue "Hypoloid" Normal Saline Solution (Sterile), in boxes of  $6 \times 10$  c.c. ampoules, and also in a combined packing containing  $6 \times 1$  c.c. ampoules "Hypoloid" Digoxin with  $6 \times 10$  c.c. ampoules "Hypoloid" Normal Saline Solution (Sterile).

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MESSRS. MAY AND BAKER inform us that they have prepared a second edition of their pamphlet on Opacol and of the pamphlet on Uropac. A second edition of the pamphlet on Myocerin for the Chrysotherapy of rheumatoid arthritis and of the one on Neo-hydriol have also been printed. Copies of these pamphlets can be obtained on application to Messrs. May and Baker, Pharmaceutical Specialities, Ltd., Dagenham.

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<sup>1</sup> These notices are for the purpose of acquainting officers with the latest developments in therapeutics, but do not imply that the preparations mentioned have been added to the list of authorized drugs.

# JOURNAL OF THE ROYAL ARMY MEDICAL CORPS

## Corps News.

NOVEMBER, 1940.

### EXTRACTS FROM THE "LONDON GAZETTE."

*Sept. 17.—Emergency Commission.*—War Subs. Capt. G. V. James (116216) relinquishes his commn. Sept. 18, 1940.

Lt.-Col. H. G. Monteith, D.S.O., O.B.E. (11641) ret. pay (late R.A.M.C. (Res. of Off.)) is restd. to the rank of Col. on re-employment in that rank. July 25, 1940.

*Sept. 24.—Short Service Commission.*—Lt. I. O. B. Spencer, M.B. (96291), to be Capt. Aug. 1, 1940, with precedence next below Capt. P. B. Williams.

*Oct. 2.*—Lt. (Qr.-Mr.) F. H. Newland (63664) to be Capt. (Qr.-Mr.). Sept 30, 1940.

*Oct. 4.*—The appt. of Lt. R. Phillipson (65499) is antedated to Sept. 14, 1934, under the provs. of Art. 39 of the Royal Warrant for Pay and Promotion, 1940, but not to carry pay and allces. prior to June 1, 1935.

Lt. R. Phillipson (65499) to be Capt. June 1, 1936, with seniority Sept. 14, 1935 and precedence next below Capt. N. D. Keys, M.B. (Substituted for the notifn. in the *Gazette* of June 2, 1936.)

Lt. (Qr.-Mr.) A. G. Williams (63667) to be Capt. (Qr.-Mr.). Oct. 3, 1940.

*Short Service Commissions.*—The under-mentioned Lts. to be Cpts. Sept. 3, 1940 :  
C. E. Brown, M.B. (100835), with seniority May 1, 1940, and precedence next below Capt. J. J. McGrath, M.B.

R. H. C. Manifold (95467), with seniority July 1, 1940, and precedence next below Capt. C. W. A. Hughes.

The undermentioned at his own request, reverts to the rank of Maj., whilst empld. during the present emergency :—

Lt.-Col. W. J. Simpson, M.B. (135569), ret. I.M.S. May 18, 1940.

*Oct. 8.*—Maj. (actg. Lt.-Col.) S. O. Dolan (9015) to be Lt.-Col. Oct. 9, 1940.

*Oct. 11.*—Lt.-Col. (actg. Col.) G. W. Will, O.B.E., M.B. (10653), having attained the age for retirement, retires, and remains empld. Oct. 9, 1940.

Lt.-Col. G. B. F. Churchill (11094), ret. pay (late R.A.M.C.), at his own request, reverts to the rank of Maj., whilst empld. during the present emergency. Sept. 10, 1940.

*Oct. 15.*—The undermentioned Cpts. to be Majs. :—

S. W. Smith, M.B. (47733). Sept. 17, 1940.

(Temp. Maj.) J. M. Officer, M.B. (47734). Sept. 17, 1940.

(Temp. Maj.) W. B. F. Brennan, M.B. (52442). Sept. 28, 1940.

### Regular Army Reserve of Officers.

*Sept. 24.*—The undermentioned cease to belong to the Res. of Off. on account of ill-health. Sept. 23, 1940 :—

Maj. W. G. Shakespeare (5103).

Capt. (War Substantive Maj.) C. R. Sadler (34220).

*Oct. 2.*—The notifn. regarding Maj. D. C. Ogilvie, M. C. (99598), in the *Gazette* of Sept. 10, 1940, is cancelled.

### TERRITORIAL ARMY.

*Sept. 21.*—2nd Lt. E. H. Eason (74325), from Yeo, (T.A.), to be Lt. July 12, 1940.

The undermentioned oftrs. relinquish their commns. on account of ill-health and retain their rank with permission to wear the prescribed uniform. Sept. 19, 1940 :—

Maj. H. Baxter, M.D. (41534).

Maj. N. F. C. Burgess, M.D., M.R.C.P. (16908).

Capt. T. H. Bates, M.D., M.R.C.P. (89837), relinquishes his commn. on account of ill-health. Sept. 19, 1940.

*Sept. 25.*—Lt. (War Subs. Capt.) J. H. Gilchrist, M.B. (99353) relinquishes his

commn. on account of ill-health. Sept. 23, 1940.

*Oct. 3.*—Maj. W. Lumley (46521) relinquishes his commn. on account of ill-health and retains his rank with permission to wear the prescribed uniform. Sept. 30, 1940.

*Oct. 9.*—The notifn. regarding Capt. (Bt. Maj.) T. E. Hastings, M.C., M.B. (47771) in *Gazette* (Supplement) dated Sept. 3, 1940 is cancelled.

Capt. G. A. F. Holloway (45056) relinquishes his commn. on account of ill-health. Oct. 7, 1940.

## THE ARMY DENTAL CORPS.

*Sept. 17.*—Maj. (temp. Lt.-Col.) B. E. Gentleman (24822) to be Lt.-Col. July 31, 1940.

*Sept. 24.*—*Short Service Commissions.*—The undermentioned Lts. (on prob.) are confirmed in their rank :—

R. C. Lewis (99983).

W. B. Hubbard (100708).

J. R. Faulkner (100930).

The undermentioned Lts. to be Cpts. :—

R. C. Lewis (99983). *Sept. 16, 1940.*

W. B. Hubbard (100708). *Sept. 17, 1940.*

J. R. Faulkner (100930). *Sept. 19, 1940.*

## QUEEN ALEXANDRA'S IMPERIAL MILITARY NURSING SERVICE.

*Sept. 17.*—The undermentioned Sisters resign their appts. :—

Miss M. M. Moroney. *June 23, 1940.*

Miss J. E. Whittingham. *July 11, 1940.*

Miss J. A. Ellis. *Aug. 3, 1940.*

*Sept. 24.*—Sister Miss M. W. Lawrence resigns her appt. *Sept. 1, 1940.*

The undermentioned Staff Nurses to be Sisters :—

Miss M. J. Cosgrove. *July 24, 1940* (with seniority next below Miss D. F. Duckworth).

Miss F. Ratcliffe. *Aug. 1, 1940.*

Miss K. M. Terry. *Aug. 1, 1940.*

Miss S. S. Boorne. *Aug. 1, 1940.*

Miss E. Roberts. *Aug. 9, 1940.*

Miss M. Diggle. *Aug. 15, 1940.*

The undermentioned Provl. Staff Nurses

are confirmed in their appts. :—

Miss J. W. Dicks.

Miss I. D. Hearn.

Miss A. M. Baker.

Miss L. M. Holland.

Miss E. M. Talbot.

Miss R. M. N. Mansel.

*Sept. 27.*—Staff Nurse Miss C. E. Curtis resigns her appt. *Sept. 9, 1940.*

*Oct. 8.*—The undermentioned Sisters resign their appts. :—

Miss M. E. Lock. *Aug. 30, 1940.*

Miss F. I. Lupton. *Sept. 16, 1940.*

*Oct. 11.*—The undermentioned Sisters resign their appts. *Sept. 30, 1940 :—*

Miss B. N. Hughes.

Miss H. F. Kilroe.

## KILLED IN ACTION.

CAPTAIN RUPERT WELPLY, R.A.M.C., was killed in action on May 27, 1940. Educated at St. Bartholomew's Hospital, he took the M.R.C.S.Eng., and L.R.C.P.Lond. in 1938.

Gazetted to a short service commission as Lieutenant R.A.M.C., November 1, 1938, he was promoted Captain February 1, 1940, with seniority from November 1, 1939.

## ROYAL ARMY MEDICAL CORPS AND THE ARMY DENTAL CORPS COMFORTS GUILD.

A GUILD is being organized to provide comforts for the men of the R.A.M.C. and A.D. Corps. It is hoped that ladies will help by working independently, or by joining local working parties.

Arrangements are being made to issue wool as it becomes available, and any subscription, however small, towards the cost of providing material will be gladly received. Cheques and postal orders should be made payable to the "R.A.M.C. and A.D. Corps Comforts Guild," and sent to Lady MacArthur, 48, Priory Road, London, W.4; or to Mrs. Clewer, 27, Park Hill, Ealing, London, W.5.

The Officers of the Corps have contributed £100 to the Royal Army Medical Corps and Army Dental Corps Comforts Guild.

Lady MacArthur, Mrs. Clewer, and the Committee wish to thank all subscribers, whether of money or gifts, to the Guild.

The money is spent on wool for the many

knitters, who are helping, and on books and games.

The Committee would be very grateful for further subscriptions, and also for gifts of paper-covered books, old magazines, and indoor games, as the requests for these have been quite overwhelming.

A consignment of woollies, books and games has already been despatched to Iceland, and more are going immediately to outlying stations, but until many more woollen garments, etc., have been received, it will be impossible to do more than touch the fringe of the men's wants at home. So will all the knitters please hurry!

Any officers' wives, living in or around London, who could give occasional help at the Headquarters Mess by packing parcels, should write to the Honorary Secretary, R.A.M.C. and A.D. Corps Comforts Guild, Headquarters Mess, Millbank, who will let them know how they can assist.

## SUPPLY OF MILITARY UNIFORMS.

THE War Office announce that orders have now been issued outlining the procedure to be adopted when military personnel, including Women's Services administered by the War Office, order uniforms from civilian firms.

(a) Officers other than those mentioned in (c) when ordering in person must produce their certificate of identity (Army Form B. 2606) to their tailor; when they order by post the order must be endorsed by the Commanding Officer and bear the unit stamp.

(b) When other ranks, including Officer Cadets, place orders with their tailors they must produce a letter endorsed by the Commanding Officer bearing the Unit stamp indicating that they are authorized to obtain uniform. This letter will be retained by the tailor.

(c) Members of the Army Officers Emergency Reserve, Officers of the Indian Regular Reserve of Officers and Officers of the Indian Army whose services have been placed at the disposal of the War Office must, until supplied with a certificate of identity (Army

Form B. 2606), produce an authority to purchase uniform endorsed by the War Office (A.G. 12) and bearing their office stamp, which will be retained by the tailor.

In order that tailors may satisfy themselves that an Officer of an Allied Force in the United Kingdom is an authorised person to purchase uniform the following procedure has been put into effect:—

Applications by Officers to purchase uniform will be signed by the head of the respective Military Mission and stamped and counter-signed by the appropriate branch of the War Office. The applications will then be returned to the Officers concerned who will present them to the tailor, who, before handing over the uniform, will identify the Officer by asking for and examining the Officer's Form D.R. 10.A.

In view of the provisions of Defence Regulation 1 (3) tailors should be particularly careful to insist on being given these proofs of identity before supplying military uniforms to any person.

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## BIRTHS.

McIVER.—At the Oakwood Nursing Home, Northampton, on July 20, to Mary Eileen wife of Major J. W. A. McIver, R.A.M.C., a son (Norman Keith Ian).

FINLAYSON.—To Nan, wife of Captain W. F.

Finlayson, A.D. Corps, at Singapore, on June 26, a daughter.

MACFARLANE.—To Betty, wife of Major L. R. S. MacFarlane, R.A.M.C., at Singapore, on July 4, a son.

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## DEATHS.

BUCKLEY.—By enemy action on October 12, 1940, Captain and temporary Major Leonard Buckley, R.A.M.C. Major Buckley was born in Crosby, Lancs, August 12, 1886. Graduating M.B. Liverpool in 1910, he was gazetted Lieutenant R.A.M.C. July 28, 1911, promoted Captain January 28, 1915, and retired receiving a gratuity October 13, 1921. He rejoined on mobilization September 2, 1939, was appointed acting Major March 6, 1940, and temporary Major June 6, 1940. At the time of his death he was Registrar and O.C. Military Section Royal Orthopaedic Hospital, Stanmore, Middlesex. During the war of 1914-1918 he served in France from September, 1914, till June, 1918, being awarded the 1914 Star, British War and Victory Medals.

GATERELL.—In Aldershot, on September 24, 1940, as the result of an accident, Lieutenant J. J. Gaterell. Born on April 27, 1912, he qualified as a dental surgeon in

1935, and was appointed to an emergency commission in the Army Dental Corps on April 22, 1940.

WHITE.—On October 12, 1940, in the Westminster Hospital, of injuries the result of enemy action received in the destruction of his residence by a bomb, Lieutenant-Colonel Charles Francis White, O.B.E., R.A.M.C. (Retired). Born January 27, 1879, Colonel White graduated M.B. of the old Royal University of Ireland in 1902. Commissioned Lieutenant R.A.M.C. on July 31, 1905, he was promoted Captain in 1909, Major 1915 and Lieutenant-Colonel on March 19, 1930. He retired December 1, 1933, and took up the Retired Pay appointment at Woking on January 1, 1934, which he held till December 31, 1938. In the Great War he served in France from August, 1914, till the end of the war. Thrice mentioned in despatches, he was awarded the O.B.E., 1914 Star and Clasp, British War and Victory Medals.



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### CONTENTS

ORIGINAL COMMUNICATIONS.	PAGE	CLINICAL AND OTHER NOTES.	PAGE
treatment of War Wounds in France, May-June, 1940. By Major J. S. JEFFREY, R.A.M.C. . . . .	345	Avulsion of Stomach from Duodenum. By Major IAN FRASER, R.A.M.C. . . . .	383
ething Troubles of a General Hospital in the Field. By Colonel S. G. WALKER . . . . .	358	Posture During Cystoscopic Examina- tions. Description of a New Pattern of Leg Support. By JOHN EVERIDGE, O.B.E., F.R.C.S. . . . .	387
is War and Ourselves. By Lieutenant- Colonel F. A. E. CREW, T.D., R.A.M.C. . . . .	367	Cerebral Influenza Simulating Early Cerebrospinal Meningitis. By Lieu- tenant GEOFFREY N. PATTISON, M.B., B.S.Durham, R.A.M.C. . . . .	388
endments to the Memorandum Con- cerning the Use of Sulphonamide Derivatives . . . . .	377	CURRENT LITERATURE . . . . .	390
EDITORIAL.		REVIEWS . . . . .	392
ighting in Factories and Ventilation During the Black-Out . . . . .	378	NOTICES . . . . .	395
		INDEX . . . . .	396

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TREATMENT OF WAR WOUNDS IN FRANCE,  
MAY-JUNE 1940.<sup>1</sup>

BY MAJOR J. S. JEFFREY,  
*Royal Army Medical Corps.*

INTRODUCTION.

ON May 10, 1940, Germany invaded Belgium, and in the course of the next six weeks upset not only the Allied military scheme but also our medical arrangements for dealing with the wounded. The medical scheme for the British Expeditionary Force was a replica of that which had been successful in the last war, with field ambulances applying the primary dressings and transferring the cases quickly back to a Casualty Clearing Station. The C.C.S. was supposed to perform the necessary operative treatment, and after a few days, when the patient was fit to travel, transfer him back to a base hospital. It would be idle to deny that this system proved entirely unsatisfactory during the intense and mobile warfare of May-June 1940. The C.C.S.s were far too immobile and could not keep pace with the rapidly moving army; and even those base hospitals which were in a relatively forward area were engulfed by the advancing army in a matter of a few days.

The surgeons in the C.C.S.s worked valiantly so far as they were able, but their hospitals usually had to move almost before they had time to start work. The upshot was that the wounded had to be transferred from the field ambulances in the forward areas straight back, and as quickly as possible, to base hospitals, which thus acted as C.C.S.s, where the first serious

---

<sup>1</sup> Honyman Gillespie Lecture, delivered July 25, 1940.

surgical attack on the wound was undertaken. Such was the rapidity of the German advance that, after a few days of intense surgical activity, each succeeding base hospital had in turn to close down because of the proximity of the enemy.

It was a tribute to the work of the regimental medical officers and field ambulances, and the motor ambulance convoys and ambulance trains, that in spite of the rush conditions, all the wounded received first-aid treatment, and were usually got to a base hospital within twenty-four hours and never later than forty-eight hours.

It is clear that the lesson for the future is that the casualty clearing station, or whatever is to replace it, must be a really mobile unit capable of moving with all its equipment at an hour's notice. An operating unit in a motor van or ambulance is not an ideal system ; but it may prove to be the most feasible, with most of the patients from the C.C.S. being taken back at once by fast ambulance columns to base hospitals as far removed from the line as is reasonably possible.

#### TREATMENT.

(1) *Sulphanilamide in the Treatment of Wounds*.—It was recognized by surgeons at the beginning of this war that we should have one great therapeutic advantage that those of 1914-1918 did not have, and there can be little doubt that the sulphanilamides have been invaluable prophylactically and during the healing of war wounds. It was, however, not the oral administration of the drug but the local application of sulphanilamide powder that intrigued the surgeons of the B.E.F.

Jenson and his co-workers (1939) first reported the success obtained in the treatment of compound fractures with sulphanilamide powder. They reported the treatment of thirty-nine compound fractures by excision of the wound and insertion of sulphanilamide powder. In none of these cases was there any development of wound infection. In ninety-four compound fractures similarly treated, but without the use of the powder, there was a 27 per cent rate of infection.

In France we were greatly helped by the work of Legroux (1940) at the Pasteur Institute in Paris. Legroux exposed the adductor region of the thigh, crushed the adductor magnus muscle with a crushing clamp, and rubbed the wound thoroughly with a gauze swab which had been impregnated with a strong culture of hæmolytic streptococci. In the control series the wound was then closed, and in the other cases sulphanilamide powder was freely disposed in the wound before closure. All the cases that did not have sulphanilamide powder inserted died in three days. Those that had the sulphanilamide pack died in seven to eight days. (*N.B.*—The expression "sulphanilamide pack," which is now used for this method of disposing the drug, does not mean that anything other than sulphanilamide, e.g. gauze, is packed into the wound.) Legroux found that death could be delayed up to eleven days if he reopened the wound and inserted more

sulphanilamide. He also found that the control series could not be made to survive over the three days even if given sulphanilamide by mouth or intramuscularly. He believed that oral administration could not produce a concentration of the drug in the blood sufficiently high to combat the local infection; whereas the sulphanilamide powder allowed a direct attack on the organism.

Encouraged by this evidence and by the favourable impressions formed by French military surgeons in some clinical cases, Colonel Leonard Colebrook Consulting Bacteriologist to the B.E.F., arranged for supplies of sulphanilamide powder to be available at British C.C.S.s and base hospitals. Colonel Colebrook thought that the powder might be of help in three types of cases: (1) It might be used in cases of débridement and primary suture, and particularly where the débridement had been for any reason less radical than is desirable; (2) It might accelerate the healing of a septic wound; (3) It might be possible to perform primary suture at a relatively late period, for example, up to twenty-four or forty-eight hours after the injury, if the powder were inserted on the battlefield or at the field ambulance. It was from this third possibility that the greatest aid was expected. I shall give my impressions of the value of sulphanilamide powder further on in this paper.

(2) *Primary Suture*.—Most of the surgeons in the B.E.F. had been impressed by Trueta's work in Spain, and when we went to France we were anxious if possible to treat wounds by débridement; that is, excision of the wound, primary suture, and immobilization in plaster of Paris. We were alive to the danger that might attend such procedure in France—the risk of gas gangrene, from the highly cultivated soil, developing later under the plaster. In practice it became almost impossible to carry out primary suture. Either the Blitzkrieg was upon us and we had not sufficient time to carry out the careful débridement necessary; or, if the patients were transferred far enough away from the line to allow of careful treatment, the wounds were not then sufficiently recent.

The only satisfactory series of cases of primary suture was obtained by Major R. S. Handley working at a C.C.S. attached to a French hospital at Metz. Here, before the invasion of Belgium on May 10, Handley had six weeks during which a steady trickle of wounded came back from the few British troops in the Maginot Line. Transport from the Maginot Line to Metz was excellent, and Handley was able to operate on his cases about three hours after the time of wounding. In a series of 25 cases of primary suture he found that 23 remained perfectly clean and 2 became septic. He attributed this success to three factors: (a) Very careful débridement; (b) prophylactic sulphanilamide therapy thereafter; (c) rest, for the wounded part and for the patient.

(a) *Débridement*.—All foreign bodies and all devitalized tissue must be removed, particularly muscle. The muscle is cut away until it contracts under the scalpel and is bleeding healthily. Nerves and large blood-



vessels are saved if possible, and the infected tissues surrounding them dissected off. Fragments of bone which no longer have a periosteal attachment are removed. A minimum of skin is removed, for skin resists infection well and will look after itself. Usually all the skin that needs to be removed is one-eighth of an inch from the wound edge, and this allows approximation without tension, which is so important. As few ligatures as possible are applied to bleeding points, using the finest catgut. In dealing with large nerves that have already been divided, it is a moot point whether one should attempt suture, or simply tie the ends together with silk with a view to making subsequent search for the nerve easier.

No attempt is made to approximate the muscles and other tissues. It will be found that when the skin is approximated and the dressings are applied, the dead space is largely obliterated. When it is feared that a hæmatoma may accumulate in a large space, a rubber drain is permissible for twenty-four hours.

(b) *Sulphanilamide*.—On the day of operation the patient is given 4 grams sulphanilamide by mouth, and 3 grams on each of the following days, a total of 13 grams.

No series of cases of primary suture plus local insertion of sulphanilamide powder was obtained in France.

(c) *Rest*.—This entails moving neither the patient nor the wounded limb for ten days, the limb being immobilized in plaster or in splints. Padded plasters were usually applied; and if an unpadded plaster is applied, precautions must at least be taken to prevent the silk-worm gut stitches in the skin becoming adherent to the plaster, otherwise the removal of the plaster may be difficult.

It is desirable that the patient be not sent on a journey if primary suture is to have the best chance of success. This was possible at Metz and other hospitals in France only before the Blitzkrieg, and may be possible in Britain with air-raid casualties.

A time limit should be adhered to, after which no primary suture should be attempted. In the upper half of the body, including the arms, suture may be attempted up to twelve to fourteen hours after injury. In the lower limbs, the limit should be six hours.

(4) *Septic Wounds*.—I was working in a base hospital at La Baule, near St. Nazaire, and because of its distance from the front, the hospital was able to go on functioning until the final day of evacuation of the B.E.F. from France, on June 18, 1940. During the preceding six weeks several thousand wounded men passed through our hands, of whom many hundreds had had nothing more than a field dressing applied before reaching us. Our records were lost in the evacuation and I cannot give precise figures.

One was struck straight away by two facts: (1) that in spite of their wounds and the long journey, sometimes as much as 200 miles, the men were in good general condition. This was, presumably, because we were dealing with fit young men; and because the vast majority of the wounds were in

limbs and soft tissues. In a hospital of 2,000 beds, there would not be more than three or four intra-abdominal wounds and a dozen intra-thoracic wounds. This was noted in hospitals in the forward areas too; and the principal explanation must be that the men so wounded did not survive, at any rate long enough to get them to hospital.

The wounds we were dealing with were twenty-four to forty-eight hours old, and therefore débridement and primary suture were not indicated. In appearance the wounds were usually dirty, with varying amounts of devitalized and gangrenous muscle.

#### OPERATIVE TREATMENT.

During busy periods we had three tables running simultaneously in our excellent operating theatre in the Casino at La Baule, with surgeons and theatre staff working in relays. Very frequently we did not see the case until it came into the theatre under the anæsthetic. This is an inevitable but undesirable arrangement; and if it cannot be avoided, then the case must certainly be seen beforehand by a competent surgeon in the wards, so as to avoid sending to the theatre small wounds that require nothing more than an antiseptic dressing.

To begin with, in our operative treatment, many of us younger surgeons were unduly radical. Perhaps we had heard too much about "excision of wounds," and to some extent forgot our surgical pathology, so that we cut away devitalized tissue simply because it was devitalized, and heedless of the infection we might be spreading thereby. With experience, and guided by Colonel Max Page, Consulting Surgeon to the B.E.F., whose advice was always so sure and so valuable, we soon gained better judgment, and thereafter excision of tissue was reserved for those cases of obvious gas gangrene.

The great majority of the wounds we had to deal with were septic, and bacteriological culture showed a mixed growth of staphylococci, streptococci, *B. coli*, and anaerobic organisms. If there was an entrance and an exit wound, our practice was simply to open up the track by cutting through the tissues between the two openings, performing a toilet on the wound, that is cleaning out any loose tissue or foreign body, and gently swabbing it clean, and then packing the wound with sulphanilamide powder. If the track could not be fully laid open because of the risk of dividing vital vessels and nerves superficial to the track, we found it sufficient to enlarge each end of the track and insert sulphanilamide powder and a rubber drainage tube.

The quantity of powder used depended on the size of the wound. Usually two heaped teaspoonfuls of powder, amounting to about 10 grams of sulphanilamide were spread over the wound; but no harm was ever seen from overdoing such dosage. We aimed at a pack of 5 to 15 grams sulphanilamide. Jenson suggests a limit of 20 grams.

The deposition of the powder in all the crevices of the wound can be difficult, especially if it has not been possible fully to open up the track.

Here experiments are being tried with sticks of sulphanilamide like crayons of chalk, and with an emulsified form of the drug that can be squeezed out of a tube like tooth-paste. Either of these methods may prove efficacious if the sulphanilamide is to be applied locally to the wound in the forward areas by the Regimental Medical Officer or at the Field Ambulance.

In our base hospital we obtained satisfactory results from a simple pump that Colonel Colebrook introduced. It blew a spray of powder wherever it was wanted, and in this way we endeavoured to get to the corners of the wound as well as the surface. Inevitably, however, there must be some crevices where the powder cannot enter, and where infection may proceed: though the fact that the powder goes into solution with the blood and tissue fluids in the wound minimizes that risk. The pump, which was foot-activated, blew a stream of air that caused a whirlwind in a bottle of sulphanilamide, and so drove the powder up and along a rubber tube which led to a sterilized glass nozzle inserted in the wound.

#### RETAINED FRAGMENTS.

Where there is only a single entrance wound it is almost certain that there must be a retained fragment, and these cases present a problem: should we proceed to search for that fragment; or should we leave it alone? It is a mistake to assume that all retained foreign bodies must be removed. In this matter a great deal depends on the size of the fragment as seen radiologically, and on the state of the wound. Where the single entrance wound is clean and small, and the foreign body apparently causing no disturbance the fragment can be left *in situ*, to be removed later if there is a flare-up of sepsis. A large foreign body, and particularly when there has been fracturing of bone, is better removed straight away or it may delay healing.

Our usual practice, in the case of twenty-four to forty-eight-hour-old wounds, and with or without the aid of X-rays, was to enlarge the wound slightly to allow for drainage, insert a finger along the track and seek the fragment. If the fragment could not be found, the search was discontinued and the case reviewed after five days. By that time suitable X-rays could be taken, and the wound would be either quiescent or becoming increasingly septic. In the latter case we again operated under an anæsthetic and explored the wound. To open up fresh, clean, and healthy tissue in any search is dangerous, though the subsequent insertion of the sulphanilamide pack nullifies much of that danger.

Multiple small entrance wounds, due to the man being "peppered" by shrapnel, we left alone. Very rarely gas gangrene develops in one of the tracks, and for that reason some surgeons insist on opening up all such wounds. But my experience of interference in such cases was that I merely enlarged an inoffensive puncture wound and failed to find the fragment.

#### SPLINTAGE OF WOUNDS.

Wounds involving limb bones and compound fractures were treated as far as possible by the closed plaster method. Soft-tissue wounds, when

large, were splinted with plaster or Cramer wire or wooden splints, and the comfort of such patients in proper splinting was quite remarkable. It had been said that closed plaster splintage in France might prove dangerous because of the risk of gas gangrene. We saw no evidence of this. The wounds we were enclosing in plaster at our base hospital were forty-eight hours old, and would have shown gas gangrene by that time if it were going to develop. None of the cases that came to us from the forward areas encased in plaster developed gas gangrene, though many of them were in extreme discomfort from the tightness of the plaster on a swollen limb.

An interesting complication of the closed plaster technique was seen in the case of a Belgian soldier. This man had been shot through the mid-humeral region. The entrance wound was of moderate size, there was gross shattering of the shaft of the humerus, and there was an enormous exit wound. The injury was ten days old by the time he came to us, and he had been continuously on the road, moving back from Belgium. A shell dressing and a rough wooden splint had been applied on the field, and that was all. He was in great pain, though he was very brave and stoical about it. On examination the wound was found to be very dirty, and there was gross œdema of the forearm and hand. I carried out a superficial toilet of the wound, inserted a sulphanilamide pack, and put the arm up in abduction, enclosing the thorax and the whole of the arm and hand in plaster. Thereafter, he was very comfortable and remained so for a fortnight, when he began to complain of itching in the region of the wound. I assured him that all was well, but the itching got worse, and one morning he produced a match-box in which were two little maggots. He had collected them as they crawled from under the plaster where it was loose at the root of his neck. I again smiled reassuringly and said it was "good" and that "we liked to see it." However, after a few more days I had not the heart to persevere, and I removed the plaster. The wound was crawling with live maggots and dead flies, but otherwise looked beautifully clean. There was a plague of flies in France during the summer, and they had got in under the plaster and produced the maggots.

#### GAS GANGRENE.

There was not a great deal of gas gangrene among our wounded in France. I saw five cases in about 2,000 wounded. By that I mean true gas gangrene, with marked systemic disturbance and pyrexia, and all the features of an acute fulminating toxæmia in addition to the gas and gangrene in the wound. What was not uncommon was a localized form with little or no general disturbance. In these cases the muscle appears gangrenous and is usually dark in colour, and a few gas bubbles may be seen in the wound and in the muscle planes radiologically, and Gram-positive rod-shaped bacilli may be isolated from the wound. In such cases simple incision and drainage of the wound was all that was necessary.

In established gas gangrene, with foul-smelling necrotic muscle and

general illness, excision must be thorough, the muscle being cut until it bleeds and contracts under the scalpel. Skin need not be widely excised. My experience may have been unfortunate, but I never saw a case of gas gangrene of the lower limb survive where radical excision had been carried out, and amputation must be considered in every such case. Amputation is preferable to the strong risk of the infection getting up into the gluteal muscles, when a fatal outcome is certain.

In the upper limb the prognosis is better and excision may suffice. In two of our cases the infection in the arm had already spread to involve the pectoral muscles. In one I did a disarticulation at the shoulder-joint and excision of pectoral muscle, and in the other Major A. L. d'Abreu did a forequarter amputation, and the patient survived.

After such operations for gas gangrene, excision or amputation, the wound was packed with sulphanilamide powder, dry dressings applied, and anti-gas gangrene serum given intravenously. The dressings were left untouched for seven days. Oral sulphanilamide was begun forty-eight hours after operation, when the effect of the local powder was wearing off, and continued in the dosage of 1 gram four-hourly for four days. There seems to be agreement that a combination of anti-gas gangrene serum and sulphanilamide is of value in the therapy. There was no evidence from France that sulphanilamide, alone and without operation, saved any case of true gas gangrene.

#### X-RAYS.

Undoubtedly in many cases of a single entrance wound the fragment will be found on passing a finger along the track ; but it is desirable, if possible, that all such cases should be X-rayed before going to the theatre in order to demonstrate the number and disposition of the fragments. The simplest way to do this is by means of an X-ray screen in the room adjoining the theatre. The patient is X-rayed in the anterior position and an "A" marked in ink over the fragment ; then in the lateral position and an "L" similarly marked. In the theatre these letters are scratched with a needle and the part washed and painted with iodine to show up the letters.

Every effort should be made to have this screening facility, as it avoids delay and the presence in the theatre of wet-plate films which accumulate in countless numbers and get mixed up. In our hospital we had to use the wet-plate method, but in those hospitals where screening was possible it gave great satisfaction.

#### AFTER-TREATMENT OF WAR WOUNDS.

There is a big field for improvement in the after-treatment of war wounds, and also of all septic wounds in civilian hospitals. Too often the surgeon's interest in the wound wanes during the weeks that the patient lies in hospital, whereas with proper care much can be done to speed up the process of healing.

Our experience was that those wounds healed best and quickest in which the dressings were left undisturbed for seven to ten days ; and the principal value of the closed plaster method of treatment seemed to be this prevention of unnecessary dressing of the wound.

The danger, particularly in large wards, of cross-infection from case to case is a very real one. We saw several cases in which the wounds were bacteriologically sterile when they came to us, sterile on the operating table, and ten days later showed a growth of hæmolytic streptococci. Such contaminants are introduced either by :

(1) *Slack technique in dressing*, with the Sister doing a number of different dressings often without adequate resterilisation of hands and instruments, and often without gloves on. Undoubtedly the difficulties are great in dealing with hundreds of wounded, and have to be experienced to be appreciated ; nevertheless all efforts must be made to maintain asepsis, and Major B. M. Dick (1939) introduced an excellent system of separate dressings for each patient—the dressings being conveniently packed and sterilized in “ 50 cigarette ” tins.

(2) *Dust*.—It has been shown that hæmolytic streptococci can exist for ten weeks in dust. Here again large wards are a danger, and proper sweeping of the ward, so that dust is not stirred up, must be insisted on. Experiments to purify the air by means of sprays are being carried out.

The great benefits of quick healing of the wound are, firstly, that cross-infection from that wound will be prevented ; secondly, that the wound will heal with a minimum of scar tissue ; and thirdly, any skin-grafting may be carried out much earlier than would otherwise be possible.

#### FRACTURES.

During the quiet period in France throughout the winter, fractures were treated on similar lines to those employed at home. As soon as the Blitzkrieg began, however, we were forced to abandon all methods that did not permit of the patient being moved at an hour's notice. Thus, for example, in dealing with fractured femurs, any method requiring the slinging of a splint to a Balkan beam was impractical, and fractured femurs were usually treated by skin extension in a Thomas's splint angled above the knee to allow of some flexion. The patients were comfortable in such splintage and satisfactory bony position could be maintained.

As a method of transporting fractured femurs, the Thomas's splint maintained the high reputation it established in the last war. I did see several cases, however, in which even a carefully applied hitch round the ankle for extension had cut through and caused necrosis of skin. For extension purposes, if the patient has to go on a twenty-four hour journey, *a skewer through the heel of the boot is safer*, and best of all is skin extension with strapping.<sup>1</sup>

<sup>1</sup> A metal spring clip which grasps the welt of the boot and steadies the foot by resting on the side bars of the splint has now been substituted for the skewer in field first-aid equipment. The skewer was often difficult to insert, caused pain, and damaged the boot.

Whatever method of extension is employed, it is important to avoid too strong a pull on the fracture. This is particularly important in compound fractures, for a strong pull puts the tissue planes on the stretch, increases congestion, and can thereby do much harm. A slack pull, of course, produces no extension, and a balance must be struck between an extension that is too firm and one too weak.

Braun's splints, for fractured thighs and legs, are not good for transport purposes, and fell into disfavour during busy times.

Wherever possible, plaster of Paris was used for fractures. Compound fractures were confidently encased in plaster if the toilet of the wound had been satisfactory, and especially when a sulphanilamide pack had been used. When the patient has to be sent on a long journey shortly after the application of a leg plaster, the plaster should always be split up the front, even if the plaster is a well-padded one. Several cases came to us from forward hospitals with varying degrees of devitalization of the toes, due to swelling of the leg after the application of the plaster.

#### TETANUS.

In an effort to prevent tetanus, the men of the B.E.F. were given two injections of 1 c.c. of tetanus toxoid, with an interval of six weeks between injections. Unfortunately, and for various reasons, such as transference to a different unit, and rush conditions, some men did not receive their second injection. A single injection does not seem to confer immunity.

I saw four cases of tetanus in about 2,000 wounded, of whom the vast majority had had the stipulated prophylactic dose of 3,000 units of anti-tetanic serum given at a field ambulance soon after they were wounded. Of these four cases, two had been given that prophylactic dose of A.T.S. within six hours of their being wounded, and all four had had but one dose of tetanus toxoid previously. In two cases the wounds were trivial and had healed by the tenth day. Two had a short incubation period of less than ten days, and both died—one from his trivial wound. The two with longer incubation periods both survived.

Treatment was along three lines: (1) Keeping the patient quiet, with avertin or rectal paraldehyde; (2) maintaining the patient's strength by glucose given through an indwelling nasal catheter, or intravenous saline and glucose; (3) anti-tetanic serum, 60,000 units intravenously daily until the spasms begin to abate, which usually is in seven to ten days.

#### BLOOD TRANSFUSION.

The value of a special transfusion service, using stored blood, was brought out in France by the excellent work of the Army Blood Transfusion Unit under Colonel L. W. Proger. The blood was taken from universal donors and was flown out from England in pint bottles, with a simple sterilized recipient apparatus attached to each bottle. A fortnight was

regarded as a safe limit up to which the blood could be used, and no ill-effects were noted from the giving of such stored blood.

The principal indication for giving the blood was surgical shock, and many of our cases at La Baule were undoubtedly saved by the promptness with which the blood could be given. It was kept at hand near the operating theatre, and was frequently given during or at the end of an operation.

Transfusion of stored blood in cases of fresh and massive hæmorrhage was efficacious, and the blood could be run in at any desired rate of flow by means of a drip apparatus. Where the hæmorrhage was of an oozing nature and prolonged, fresh blood proved of greater value than stored blood.

Plasma, in fluid and in dried form, was on the point of being used when we had to leave France.

#### ANÆSTHESIA.

The anæsthetic of choice, in operations on extensive wounds, was nitrous oxide and oxygen, sometimes with ether in addition. A Magill's intra-tracheal catheter was used almost invariably, in order to give better anæsthesia and save gas. For short cases, and in wounds about the face, intravenous pentothal proved satisfactory. The pentothal was usually given through a saline intravenous-drip apparatus, so that the anæsthesia could be prolonged if required by running in more pentothal. No trouble was seen when the pentothal anæsthesia was prolonged to forty-five minutes on occasion. When our supplies of nitrous oxide began to run short we fell back on ethyl chloride and ether, and chloroform. Spinal anæsthesia was never used for war wounds, and local infiltration or regional anæsthesia only occasionally in clean and minor wounds.

We were fortunate to have working with us at La Baule a highly-skilled anæsthetist in Major E. S. Rowbotham, and though we had to operate on many very ill patients we had no fatalities in the theatre.

Rowbotham cut down the post-operative pulmonary complications in our hospital from what had been quite a high incidence to a minimum figure by means of "ephedrine replacement." Immediately before the commencement of the anæsthetic the patient was instructed to blow his nose hard, and the weak ephedrine solution was squirted up each nostril while he held the other nostril and sniffed. The rationale may be that many post-operative pulmonary complications are secondary to a sinus infection acquired during the anæsthetic, and the ephedrine renders the sinuses less liable to infection.

#### IMPRESSIONS OF THE VALUE OF SULPHANILAMIDE POWDER.

It is unfortunate that, in spite of the fact that sulphanilamide packs were used in the treatment of several hundred war wounds in France, one can only, so far, give clinical impressions of its value in the cleansing of wounds. Many of our scientific records were lost in the hasty evacuation from France.

The true worth of the powder is a question that should be quite easily



settled with a well-controlled series of cases, giving sulphanilamide powder to one hundred limb wounds, no powder to a second hundred, and possibly oral sulphanilamide to a third hundred. In the last three weeks in France we began such a series, with bacteriological control before treatment, and at regular intervals afterwards ; but we were evacuated before we could come to a satisfactory conclusion.

From my impression, and it was shared by the other surgeons working with me—Lieutenant-Colonel A. E. Porritt, Major A. L. d'Abreu, and Major R. S. Handley—I would have little hesitation in saying that those wounds that had had a sulphanilamide pack looked cleaner after an interval of five days than those that had no sulphanilamide. (We used to examine those wounds we were interested in, and take cultures at intervals, although we realized that for the wound it would have been better to leave the dressings untouched.) We saw several cases where, at the original operation on the wound, (1) a heavy mixed growth of organisms was obtained—staphylococci, streptococci, *B. coli* and anaerobes ; and (2) a toilet, but not a débridement, of the wound was carried out with insertion of a sulphanilamide pack ; after five days these wounds showed no growth or organisms on culture. Sometimes there would be a solitary bead of pus in the depths of the wound containing staphylococci.

I saw three cases in which the knee-joint had been exposed by a shell fragment, and the wounds were septic. Sulphanilamide powder was inserted into the joint cavities, and the patients ran an afebrile convalescence and had no serious infection of the knee.

Similarly, in the case of a depressed fracture of the skull, with a cavity in the brain tissue the size of a hen's egg, sulphanilamide powder was emptied into the cavity, and the wound remained clean and the patient afebrile.

As regards the effect on the healing power of the wound, sulphanilamide powder is said not to be deleterious to the tissues ; and, so far as it helps to sterilize the wound, must contribute to quicker healing. We were not able to come to any conclusion on this matter, because most of our cases were evacuated by hospital ship to England before the wounds were healed. But one can speak of the appearance of the wound after five or ten days. It was an interesting appearance. After five days the wound looked clean but rather quiescent and unreactive. The muscles had almost a salmon colour and there was little bleeding. The colour is possibly due to the remains of the paste that the powder forms with the body fluids. In all, rather a dead appearance, but at the same time not an unhealthy appearance. After ten days the wound looked more normal and was well on the way to healing.

The question whether the wound would not heal just as well if the drug were given by mouth can only be settled by clinical trial. But there is evidence from the work of Legroux that local application will produce a very much higher concentration of the drug at the essential point, that is in the wound. Jensen stated that the local application of sulphanilamide

in his cases produced a concentration of 800 mgm. per cent of blood, whereas systemic medication with sulphanilamide aims at only 10 to 20 mgm. per cent of blood. In other words, the local application produces a concentration eighty times greater than when the drug is given by mouth.

It should be remembered that the action of sulphanilamide is not a general one upon the body's defensive mechanism, but a local action upon the organism itself by some means not yet fully appreciated—possibly by upsetting the metabolism of the organism.

#### SUMMARY AND CONCLUSIONS.

(1) War wounds with the B.E.F. in France were treated in early cases by débridement and primary suture ; in late cases by incision, or leaving alone. Gas gangrene was treated by wide excision or amputation.

(2) Sulphanilamide powder applied locally into the wound appeared to combat infection.

(3) Plaster of Paris splintage of wounds was of value, particularly in preventing too frequent changing of the dressings.

Colonel Colebrook left us with three problems on which to continue working, and which I pass on to those who will be dealing with massive casualties in Britain :

(a) Does sulphanilamide control the growth of organisms before and after débridement ? (b) How can late infection of the wound be controlled ? How does it occur ? ; (c) How can wounds be made to heal more quickly ?

I should like to express my own gratitude, and that of the other surgeons in the B.E.F., to Colonel Max Page for his constant and kindly guidance of our work on the wounded ; to Colonel Leonard Colebrook for his lead in the use of sulphanilamide, and for the stimulation that his enthusiasm inspires ; and to Colonel John Weddell, Consulting Surgeon to the B.E.F., who arranged all our surgical supplies, so that we could not have wished to work with better equipment.

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## TEETHING TROUBLES OF A GENERAL HOSPITAL IN THE FIELD.<sup>1</sup>

BY COLONEL S. G. WALKER.

THIS Society has been treated by my predecessors to addresses of such a high standard on professional subjects that it is a relief to me to give an address entirely on administration.

My unit, a General Hospital, is the last but one to be established in this area, and thus we are able to take advantage of the experience of our neighbours. They have warned us of the many teething troubles that may be expected in the rearing of our child, and have given us the benefit of the lessons they have learnt in overcoming their difficulties.

I take this opportunity of thanking these officers and their staffs for their wholehearted assistance.

It is hoped that the lessons learnt by our combined experience may be of assistance to some of you who may find yourselves in a similar position.

Our unit does not exist in peace time—the date of its birth is that of general mobilization—in this case, September 1, 1939. During the period of gestation (Peace), it exists in embryo as part of the mobilization scheme only. This scheme lays down which stations will supply the various personnel, and the places at which they must report.

The key officers, viz. the Commanding Officer, the Registrar, the Quartermaster and the Matron are detailed by name. To keep these schemes up to date is the duty of various responsible officers at the War Office and other places, and it is not an easy task.

The unit began to mobilize on September 1, and by September 21, everyone there knew the name of the future Commanding Officer, yet he himself was not notified until the 22nd. During these three weeks, the second in command and his key officers had begun to nourish and rear this tender infant.

The various departments with which we had to deal were working under difficult conditions—their regular staffs were mobilized, and they had to carry on with make-shifts, with the result that we experienced considerable difficulty in the completion of Army Form G. 1098.

Last, but not least, the second in command had to select for promotion, on probation for three months, privates and corporals to fill responsible N.C.O. posts. This was a most difficult task, especially as it had to be done in such short time with very little opportunity to know the men.

The work was well done, so that when I joined the unit, this mixed personnel, collected from all over the United Kingdom was taking shape,

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<sup>1</sup> Address to a Medical Society, April 17, 1940.

and enabled me to get on with making it into a unit fit to compete with other Regular units.

My first action was to centralize the personnel. I found 80 Sisters housed in two hotels, 35 officers in four hotels, and 220 other ranks housed three miles away. Sisters and officers were collected in one hotel, thus saving the Government 15s. per week per sister, and incidentally, a similar amount for each officer and wife.

The total personnel, 335 in all, was unwieldy and was divided into four sections, each of which contained, as far as possible, equal qualifications and trades, the object being :—

(1) Easy handling as regards drill, fatigues, and routine duties and movements.

(2) An opportunity for officers, sisters and men to get to know each other.

(3) To make each section self-supporting should it be required to set up a hospital in a separate building.

(4) Rapid and efficient technical training. (40 per cent of the Other Ranks were Militiamen, knowing nothing of the technical side of the Corps, but they soon proved themselves excellent fellows in every way.)

(5) Emulation and friendly competition in work and games.

After a few weeks the unit began to appear out of this amorphous mass as a lusty and vigorous adolescent, and we were ordered to France. The train was due to leave at 8 a.m. on the date of departure, and to avoid the black-out, the station-master allowed us to load the heavy kit the previous afternoon. At 8 p.m. I was told the Sisters were not to accompany us, so that all their kit had to be unloaded from the train in the black-out.

We crossed the channel—the officers and men—without mishap, except for the rough sea, and on arriving at the Base, we were ordered to proceed to our destination and establish a hospital.

On arrival, all officers volunteered to help unload the huge train loads of stores and supplies, so that we had Harley Street specialists, dressed in cooks' clothing, cheerfully doing coolie work alongside the men, and gibing a fellow specialist in another section to greater effort.

A reconnaissance of the selected site was made with a view to establishing :

(1) A tented hospital ; (2) A special hutted hospital ; (3) A Nissen hutted hospital.

The area allotted already contained roads so that our plan had, of necessity, to conform with them, making a regular camp impossible as most of the plots were triangular in shape. The solution was made more difficult by the presence on the site of a large building, a disused hotel, which had been used as a hospital in the last war, and it was finally decided to recondition this building and to convert it into a hospital for 700 to 800 beds, also to build huts for 500 beds and to pitch tents for 900 beds, this was for crisis expansion.

Sites had to be selected to accommodate personnel—Officers, Sisters, V.A.D.'s, A.T.S., and R.A.M.C. Eleven small bungalows were in existence

and they were used to house offices, laboratories and out-patient departments. Sites for camp structures, cookhouses, ablution benches, latrines, etc., had also to be selected in consultation with the Sappers. Finally Horsfall incinerator and Thresh disinfector had to be housed; concrete floors for these structures are a necessity. All the above had to be fitted into an area dissected by roads. To do this a large plan of the ground was made to a scale of 1/1000, and using strips of cardboard cut to scale to represent huts or tents, it was simply a jigsaw puzzle to make them conform to the shape of the ground to the best advantage.

There is nothing laid down as to the size of wards in a tented hospital so, relying on experience in the last war, I decided on a tent to accommodate 36 beds. Also, where the ground permitted, three of these tents were put in line (end on) fitting the service, duty, and annexe tents in between (see plan fig. 1).

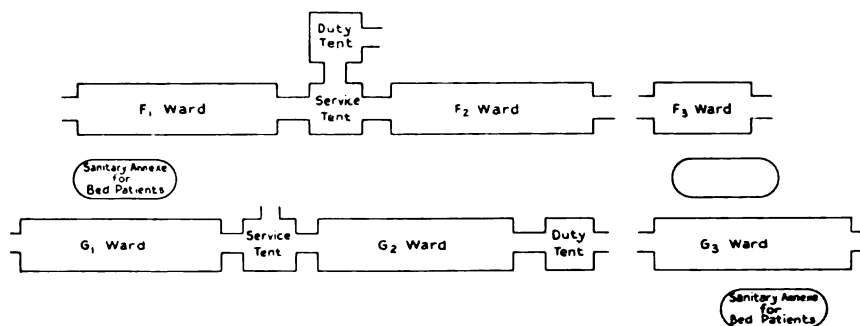


FIG. 1.—Two units of 3 wards each, complete with their duty tent, service tent, sanitary annexe.

This made an excellent unit for convenience in nursing and doctoring, and for economy in tentage, and greater safety in the event of fire. With three stoves in each tent, the patients were very warm and comfortable and stood the test of the bitter cold of last winter.

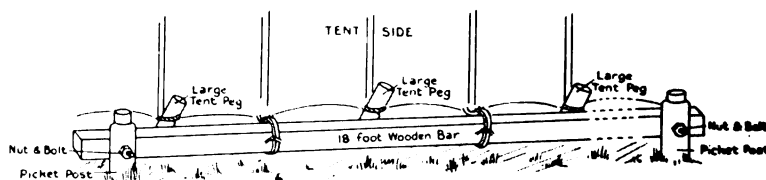


FIG. 2.—System of securing tent sides. Wooden bar bolted to picket posts.

The site is a wind-swept terrace and the only way to keep tents standing was to use double flies, and tie the outer fly to strips of wood eighteen feet long, the ends of which were bolted to picketing pegs (see fig. 2).

1,020 picketing pegs are allowed for 1,200 beds—we found 3,000 necessary for 900 beds.

The Sappers made a sanitary annexe of wood (*see fig. 3*), to be placed between the ward tent and the duty tent—one side—for bed pans, brooms, etc., and the other for two Elsan closets. Although these are excellent and most useful the local sanitary pundits turned them down. I strongly recommend them. The service and duty tents were furnished by Sisters who, by fair means or foul, obtained wooden cases and bullied the carpenter into making improvised cupboards and tables.

Shortage of labour and material retarded the growth of the hospital,

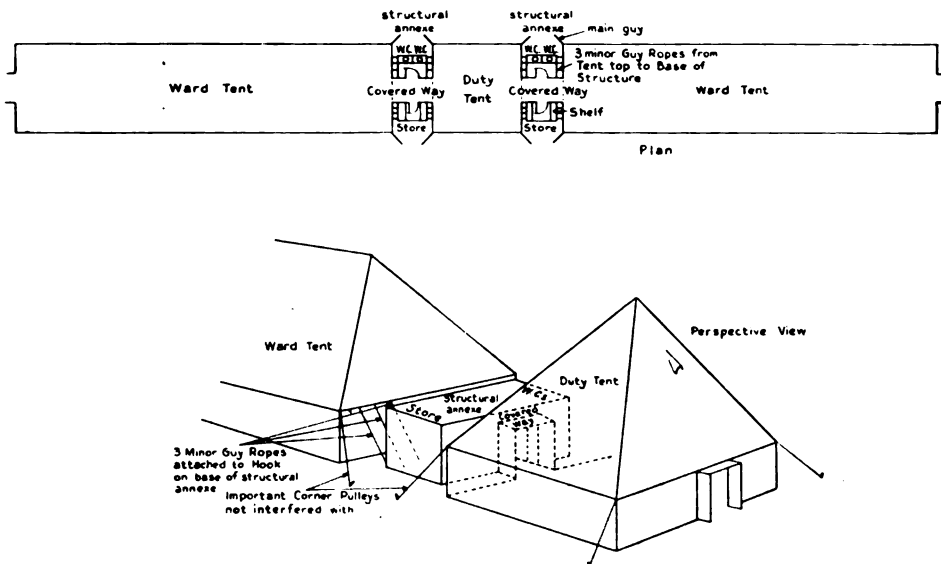


FIG. 3.—Sanitary annexe forming part of covered way connecting duty tent to ward tent.

nevertheless, we turned our attention to the erection of the following important buildings :—

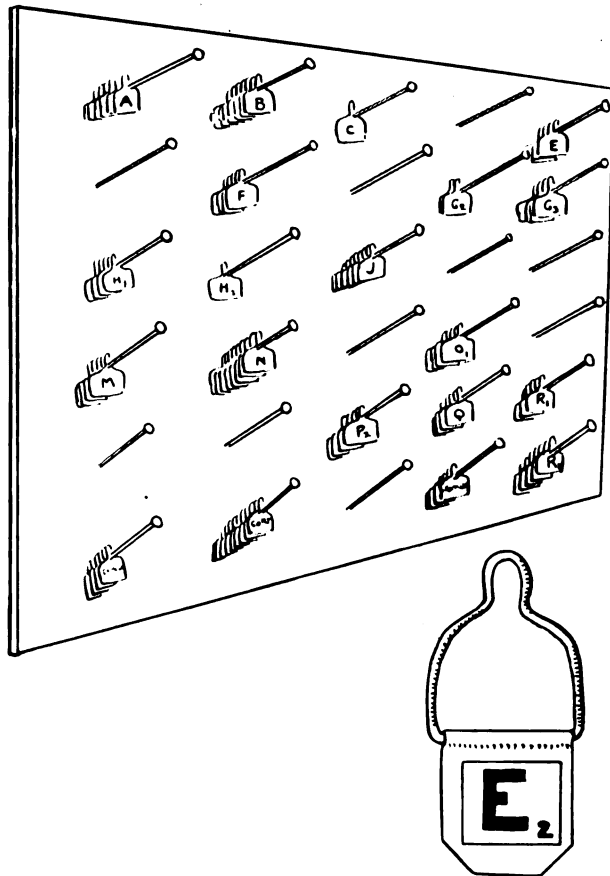
**Coal Yard.**—The amount of pilfering in small quantities of coal is amazing. A washerwoman put up her price from  $3\frac{1}{2}$  francs to  $4\frac{1}{2}$ , and when remonstrated with, replied : “What do you expect when you put a guard on the coal.”

**Post Office.**—An efficient postal service is most essential : Two rooms are used. In one four large post bags, supplied by G.P.O., are fixed to a wall and labelled “Officers,” “Sisters,” “R.A.M.C. Personnel,” and “Patients.” Letters are sorted into these in bulk and those in the first three are sent to the appropriate owners. On the next wall are 24 pigeon-holes arranged alphabetically and patients’ letters, i.e. contents of bag 4, are

placed in them. On the third wall smaller post bags are arranged by wards and patients' letters placed into the appropriate bag. Card index system is used for giving correct location.

The second room is for parcels. Two patients from each ward or tent collect the letters. No one else is allowed in the Post Office.

In addition there are letters for discharged patients : these are forwarded



Zinc tally (half size).

FIG. 4.—Board of tallies used during admitting convoys.

to an address obtained from the card index. Censorship of letters of patients is done by sick Officers and Warrant Officers.

*Police Control.*—Whole camp must be enclosed with barbed wire and the area patrolled by police wearing correct arm-band R.M.P.

No local civilians will be allowed in the area without a pass signed by the Registrar.

*Guard Room.*—This is essential for violent drunks, if any.

*Hairdressers' Shop.*—Three hairdressers are required and they must be supplied with proper tools and accommodated with requisite furniture.

*Sanitation.*—According to the establishment only 1 N.C.O. and 2 men are allowed to deal with this most essential work. These are woefully inadequate. The minimum is 1 Serjeant, 1 Corporal and 10 men, which we got from the A.M.P.C. Also each tent must detail two men to remove cinders, dry refuse and swill; these men and the sanitary squad being distinguished by a yellow arm-band. No receptacles were provided so they had to be improvised and they required concrete pedestals. Medical officers are responsible for sanitation in the vicinity of their own tents or huts.

*Dining Hall.*—As many walking patients as possible go to the dining hall and each man must present a tally. The basis is "No tally—No dinner," as otherwise some men would have two dinners. The Steward sent the requisite number of tallies to each tent or ward. If it is necessary to "stagger" the dining-hall diners because of lack of accommodation, tallies of different shapes must be used.

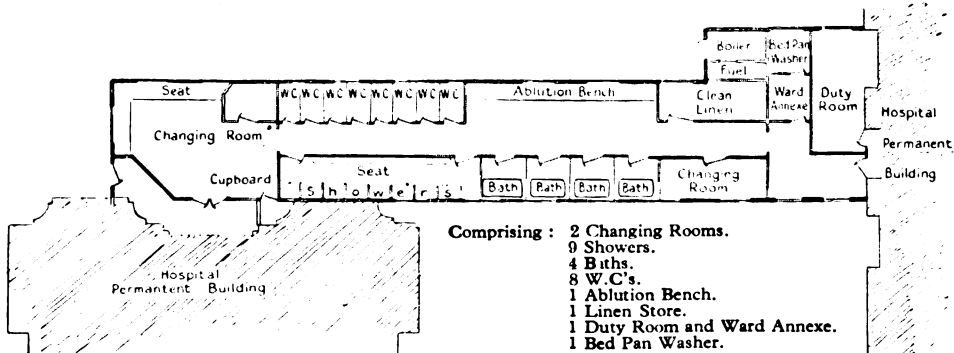


FIG. 5.—Admission unit.

The Dining Hall must be provided with a receptacle for hot water in which each patient washes his plate, etc., and also a bath of water heated on a gas stove, so that men's table utensils can be dipped in to warm them before meals. The new Dining Hall will be divided into four compartments each to hold 125 patients, each having a pantry, hot case and washing-up place. Table cutlery, etc., will be kept there and not handed to patients, in order to eliminate thieving. Bed cases had to sign for their table-ware, otherwise much of it would disappear.

*Admission.*—The admitting staff consists of two medical officers and eight clerks. The clerks write down particulars on buff forms. The medical officers allot men to wards and put the appropriate tally on a button (see fig. 4). Guides then take them to their respective wards. The A. and D. Book and A.F. I 1220 are filled in from the buff forms the same evening. Details of new admission unit whereby 100 walking cases can have a shower bath per hour and so enter the hospital clean are shewn in fig. 5.



*Discharges.*—All discharged patients are paraded and seen by me or by the Registrar, and each man is asked : “ Is your kit complete ? ” “ Are you all right ? ” “ Have you any complaints ? ”

The maximum period patients can be in hospital is twenty-eight days. To ensure this a return showing the nominal roll of all cases over twenty-eight days is submitted to Headquarters on midnight Mondays, so on Tuesday mornings a nominal roll of all men who have been in hospital twenty-one days should be submitted to the C.O. and the O.S.C. Medical and Surgical Divisions. This gives seven days in which to dispose of them. The first return called for showed seventy men on the list, but the list is now never more than four, using the above system.

*Patients' Pay.*—A day is allotted to each ward for pay. On the preceding day the Army Book 64 of all men requiring pay is collected by the pay clerk and taken to the office where a nominal roll is then made of all payments under the headings (1) Discharges ; (2) Ordinary.

Army Books 64 are arranged in units and passed to another clerk who makes out the Acquittance Roll. A.B.s 64 are then dealt with and payments entered. The amounts on A.B.s 64 and the Acquittance Rolls are totalled and they must tally. A statement of the numbers and denominations of notes required for each tent or ward is made out and given to the paying-out officer who makes up the required packages. The next day—pay day—the patients for discharge are paid out first by wards, each man signing the Acquittance Roll and handing his A.B. 64 to the paying-out officer for signature. The wards are then dealt with similarly. It has been found convenient to allot a definite hour during which patients can make inquiries about matters affecting their pay.

#### COMMANDING OFFICER'S INSPECTION.

The whole hospital must be inspected once a week, noting cleanliness, comfort of patients, efficiency of personnel, diet summaries, and to see that medical officers and sisters deal expeditiously with the discharge of patients. By this weekly inspection signs and symptoms of trouble can be seen and dealt with early. Also the dispensary, linen store and the dangerous drug cupboards are examined to see if properly protected and also that due economy is observed. A medical officer is attached to each of the stores for a month and a certificate is obtained that the store is correct as regards quantities. The Commanding Officer's and Quartermaster's duty is to keep an eye on quality.

#### FATIGUES.

The shortage of personnel is made up by using patients for fatigues such as coal, sanitation, potato peeling and gardening and any other duties around the hospital.

## COMFORTS.

The British Red Cross has been very useful in providing numerous comforts for the patients and all these are entered up in the matron's ledger which also serves as an expense book.

Our library, aided by the British Red Cross, is growing rapidly, and is a boon to the patients and also to the personnel. It is in charge of the Padres. A 5 franc deposit is required for each borrower as insurance against loss of books. We have an excellent selection of books and the library is a busy place. Newspapers are supplied by the N.A.A.F.I.

A very important department in the hospital is the pack store, and as the number of patients is increasing steadily and will continue to do so as the war proceeds, so the necessary accommodation must be expansible. This must be borne in mind when allotting space and some difficulty may be encountered. The P.A.D. equipment is always left in each patient's possession.

## FIRE PRECAUTIONS.

Fire precautions are naturally most important not only from accidental fires, but from the standpoint of P.A.D. This department is in charge of the P.A.D. Officer, who sees to the issuing, disposal, good working order of all the equipment and the necessary training of personnel.

The following is, briefly, the scheme for fire fighting in this General Hospital:—(1) A general fire alarm signal; (2) A fire picquet, which changes daily, and for the night, a full-time fire picquet, which changes weekly.

*Tents and Huts.*—(1) Each tent and hut has one or more hand fire extinguishers, and alongside each stove are several buckets of sand and water. These are generally empty four-gallon petrol tins fitted with cross-bar handles. There is one slashing knife in each tent to provide means of escape.

(2) At intervals throughout the camp are 8 sheds fitted with a glass-fronted key container; each shed holds 2 large wheeled extinguishers, 3 buckets, 1 shovel, 1 hand axe, 1 pair of hedging gloves, 1 stirrup pump, A.G. eye shields and brushwood beaters. These represent the second line of defence.

(3) A trailer pump alongside a large centrally-situated tank of water. This is the third line of defence.

Buckets of sand and water and one or more hand fire extinguishers are allotted to each ward. Also five hose reels each 90 yards long, one for each floor and five Chubb fire escapes.

One last word, it is essential that some such stage as has been described should be completed before patients are admitted, otherwise it is very difficult to make up leeway. Higher command will be continually at you for beds, beds and more beds.

*Type of Patient.*—It is well to remember that most of our staff of officers

and Sisters come from large city hospitals in which the beds are filled with serious cases, so that they must be warned of the type of case they are likely to get, and it must be explained that in war there are no light duties in the forward areas, but there will be some at the base. There the majority of cases, except during actual battles, will be of the out-patient variety from a civilian point of view.

I have given some idea of the teething troubles of a general hospital in war.

Finally, I should like to put on record what a pleasure it has been to work with such a team as it has been my privilege to command. With their willing assistance conundrums are easily solved.

I have not mentioned the hospital office and the Q.M. duties, and their troubles. The office is the Registrar's job and requires a discussion in itself.

THE WAR AND OURSELVES.<sup>1</sup>

BY LIEUTENANT-COLONEL F. A. E. CREW, T.D.

*Royal Army Medical Corps.*

As befits one who wears this uniform, I am about to exhibit a variety of courage—the courage to speak on a subject of which I have no special knowledge and about which the opinions of many who are here can rightly claim far more weight than can mine. However, I choose to entertain the notion that the prime purpose of these meetings is not the utterance and acceptance of doctrine but the presentation, evaluation and exchange of opinions. I offer some of mine for your consideration and if, as a result of the discussion which, I hope, will follow, I find cause to jettison any of them, I shall have suffered no loss, for none of them is precious to me. Indeed I am always rather glad to change an opinion for I find that if it is held too long, there develops a tendency to grip it tenaciously so that it becomes a conviction out of which can spring prejudice to grow into hatred and oppression.

When discussing this subject, we have to acknowledge at the very beginning that not only are we members of the medical profession but that we are also members of a particular human society to which the name British has come to be associated. This being so we shall find it difficult, if not impossible, to disentangle our interests and reactions as medicals from those which relate to our associations with this society.

We, as Britons, are taking part in the fashioning of history, possibly even in the reshaping of the world. If this is not so, then this war can have no meaning for us. We are not inanimate flotsam drifting listlessly upon the deep unquiet waters of circumstance: we are conscious sentient participants in a great biological drama. I wish to submit for your consideration a point of view which, to my way of thinking, is to be accepted as a basis for all present argument and action. The further evolution of mankind and of the social institutions which it has invented, lies not in the lap of some capricious god but is even now being determined and will continue to be determined by mankind itself. The rate and the direction of this evolutionary process will be decided by the magnificence or otherwise of human aspirations and by the quality of human intelligence.

We, with reason, entertain the view that, faulty as our present political and social structure is and imperfect as our achievements as a society have so far been, the ideals and ambitions which now mould our national and international attitudes and launch our actions are infinitely finer, far grander and much more worthy than were those which they have replaced. We

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<sup>1</sup> The opening contribution to a discussion arranged by the Edinburgh Branch of the British Medical Association.

hold the view that not only are we ourselves the product of an evolutionary process but that so also and equally are our social institutions and our political creeds.

We, as a people and as a society, have grown, progressing towards an ever increasing individual and social dignity. In proceeding towards a social maturity we have put away many of the impertinances of political juvenescence. We assess our quality as a people and are content to be judged by others by, for example, the development among us of a growing determination never again to impose our preferences upon others. This attitude is not to be regarded as a sign of our decadence as a political group, but rather as a token of our increasing social worthiness. The Empire that was builded as a testimony to our unrestrained fertility and to our militant might, has now been transformed into a Commonwealth which includes those parts of the earth which we have truly colonized in a biological sense and others in which we could not flourish but which we merely exploited. We no longer intend to batten on these and we claim with truth that we are there only until their peoples themselves can take over from us the responsibilities for the further guidance of their political and social destinies. This may be an instance of the conversion of a biological necessity into a political virtue but it is not hypocrisy ; it is an intelligent recognition of realities. We, through suffering, have profited from experience ; we have achieved a relatively high degree of intellectual, political and economic freedom, ever demanding more, and we have given and are giving to others those privileges which we ourselves enjoy.

We have been eagerly attempting to provide the optimum environment in which an equality in respect of opportunity should be the birthright of all ; to create an age of plenty and of leisure. Our achievements have, at all times and in all ways, fallen far short of our aims but saddening as the recognition of this may be, it is, in fact, merely a testimony to the quality of our aspirations. We have, as a human society and according to our lights, achieved much, and not so long ago we had every reason to think that we would, in time, have made of this country a place fit to live in and have created a humanity fit to live in it. During this recent evolutionary phase we have, at all times, taken care to avoid tyranny within our country and to prevent domination from without. This has ever been the problem of those who would be free and we, like all other human societies, have, for this very purpose, evolved a system of government by committees and created and maintained armed forces. These latter, with us, in the recent past, have been instruments fashioned by Society and used by Society to give effect to the public will. They have been the servants of the people.

History shows that whenever military forces are called into being within a society there invariably develops between the military and the civilian interests a conflict which, in many societies, has proved to be disastrous. The instrument fashioned to prevent tyranny has often become tyrannous, dominating the society which created it and subjecting its people. We

have learnt from history and so it is that our community, now wholeheartedly devoted to the furtherance of a peaceful evolution, mistrusts the military spirit and in times of emergency when the military forces are unleashed, the civilian mind is inclined to hinder the military even though both are striving to a common end.

Some few months ago we watched, sad and anxious, as peace lay adying and then in the flames of war we saw our hopes destroyed. For the time being, most, if not all, of our schemes for human and social betterment have had to be restricted or else abandoned and we, as a society, are required to devote ourselves to the single firm purpose of defeating the enemy : not the German who has been taught to hate the Briton but the forces that are inimical to our philosophy of life, that would prevent the further development of our society with its worthy social and political creeds and practices. This war is a clash of cultures and we who, with reason, so much prefer our own are prepared to defend it. If this be our attitude let us remember that never again must we allow ourselves to impose, or to attempt to impose, by force, our views upon others who prefer their own. Preferences must in the future be fought with argument and example and not with force.

If what I have been trying to say is warranted then you and I, not only as Britons but as doctors also, are heavily and professionally concerned. Into the very fabric of our society, our profession has been intimately woven to occupy a very prominent place and the price for prominence is responsibility. We especially have been responsible, personally and as a group, for the promulgation of ideas and for the elaboration of schemes which promise and produce human and social betterment. We have been the architects of the new world in which our people shall live. We, above all others, have reason to hold the view that this war is peculiarly our own. for it is our work in the field of social reconstruction that is now threatened with destruction. We need peace, long and continued, if we are to secure the opportunities we seek to give to mankind the great gifts of medicine. We are men of peace, but when tyranny threatens to destroy not us but the ideals for which medicine pre-eminently stands, there is but one thing for us to do, to defend them with our lives.

I say this deliberately in order to clear away any misconception concerning the role of our profession in a total war. There is a notion abroad, eagerly nurtured by tribunals, which suggests that the medical in war is a kind of benevolent neutral, standing sadly aloof and garbed in somewhat saintly dignity, behind the serried ranks of lusty men who kill and die, tending the hurt with gentle unsoiled hands and soothing the frightened with cool benignity. This simply is not true, and we must not deceive ourselves or other people. The fact that we succour the enemy's wounded is definitely related to the further fact that these, being saved, are still lost to the enemy. As far as our own troops are concerned we prevent illness, repair defect and save life solely in order that life may be destroyed. We

are more actively engaged in killing by proxy than are all the rest who are serving the fighting man.

We must not hide behind those who through our efforts are sent forth to kill ; we must not seek the shadow of that presently outmoded symbol of relative decency—the Geneva cross. We must openly acknowledge that we in our own ways are militant in attitude and in action, eagerly and violently engaged in the struggle for the preservation of our social creeds, for the perpetuation of those ideals and aspirations which have taken root and blossomed in our Society and which we have tended.

It will never be enough for us merely to be active, busily absorbed in satisfying energy-expenditure which leads to comfortable fatigue and dull forgetfulness. We owe it to ourselves and to our profession eagerly to inquire if the profession is now giving the best possible service to the community and further to cogitate concerning the possible effects of this war upon our Society and therefore upon our profession in its relation to Society.

War has the quality of simplifying and intensifying the life of a community. Under its whips a multitude of social projects, many of them mutually conflicting, and a great diversity of opinions, give place to one single simple plan and one desire, that of organizing the community in such a way that everyone and everything in it may contribute to the utmost towards the overthrow of the enemy and the return of peace when once more we can turn our thoughts to creative and enlarging dreams.

It is pitiful that a catastrophic event such as war should be required to stimulate a people into activity of this kind and intensity ; that hatred or fear must be evoked before a people can become unified in endeavour. You and I could name enemies far more antagonistic to our community than is the creed which Hitler in his person symbolizes. Poverty, faulty education, stupidity, preventable suffering, these are powerful enemies which threaten to overwhelm us, yet no armies oppose them, against them fight no Ministry of Information, no Ministry of Economic Warfare. For their conquest we should need a general staff even better than that of the German war machine and a leader even more attractive to us than Hitler is to the Germans.

I like to toy with the idea that the organization which this war will provide and which will be used for the time being for the relatively unimportant purpose of preserving our present social organization, will be used when peace returns for the much more important task of creating a new social order which will be in harmony with our aspirations.

As far as our profession is concerned, it seems to me that, in the rearrangements made necessary by changed circumstances, it will evolve an organization which will enable us to give individually and as a group our most effective service to the community. Furthermore, there is no reason, so far as I can see, why this organization, developed as a reaction to war, should not prove to be the best in the peace that will follow. As far as we are concerned peace is war, though the enemy may be different.

We must not look upon the organization of the profession as it is to-day as being that which will exist when the war has run its tardy-gaited course for several years. To-day, nothing would be easier than for any one of us to provide an illustration of what might be regarded as an instance of crass stupidity or of gross mismanagement on the part of those who are attempting to cope with the unexpected and unforeseen problems relating to medical organization. But these are really the faults of unpreparedness and merely furnish added proof for the contention that those who wish for peace do not easily prepare for war. Besides, if we criticize, we do not criticize ourselves! If there has been unclear thinking and imperfect planning, then we ourselves are at fault, we who so often and so loudly have announced our claims to wear the robes of the elder statesman.

The task before the profession in its reorganization for war was that of providing adequate reinforcements to the medical services of the armed forces and, at the same time, so rearranging the civilian medical services that these, in addition to enlarging and intensifying all those activities which are concerned with the maintenance of health of the general population and with the prevention of defect and derangement, could cope with civilian sick, air raid casualties and great numbers of expeditionary forces casualties.

Though it would seem to be easily possible to regard these varied activities as parts of one concerted plan, it was but inevitable that, in the beginning of the reorganization, there would develop a certain conflict between the interests of those who were medically responsible for military casualties and of the others whose first charge was the preservation and adaptation of the civilian medical machinery. Until very recently there has been a raging battle of the beds. Obviously since the number of military hospitals and of military beds in this country in 1938 was no greater than the number in 1914 and since it is impracticable to build and equip new military hospitals in a night, so long as the military demanded that military patients should be in military beds and so long as civilian hospitals were retained for civilian patients or kept empty until air raids filled them, so long would the conflict of interests continue and become intensified. However this war of the wards is now ending as all wars should end, before they really begin, in a laughing recognition that the whole affair has been ridiculous and futile. It is now agreed that the occupant of a bed should not be chosen by reference to the colour of his pyjamas. The military and the civilian medical authorities are now working in the closest harmony to provide the best possible hospital service for the population as a whole, and the population includes the combatants no less than the colliers.

This integration of the profession, so far as the hospital services are concerned, is indeed most heartening and we should praise those who have made it possible. We should do more; we should do everything in our power to make this *rapprochement* between the military and the civilian branches of our profession even more complete. To begin with we should



combat and eradicate the notion that it is more meritorious to serve in khaki than in mufti, that there is a greater opportunity for real devotion in the trench than in the slum. I know that the pernicious patter of propaganda attempts to make it appear that this is so. But we of the profession must never allow ourselves to forget that we are in medical charge of the population as a whole. If, in our eager search for what is termed glory and which these days is so readily rewarded with rank and ribbons, we neglect the homes and the crèches of the people, we shall have failed in our duty. The uniform all of us wear is the robe of a learned profession and we must not allow any shade of blue or brown to hide it. Obviously some of us must be enrolled in the medical services of the armed forces but we must strenuously oppose the view that those who are called are greatly to be praised or envied.

One of the most saddening experiences I now all too commonly endure is that of meeting medical men who are confessedly glad to escape from the practice of civilian medicine. There is something radically wrong here, either with the men or else with the system.

I wish to submit that the profession has erred grievously in encouraging an unwarranted distinction to be drawn between the specialist and the generalist in medicine. The two can, in the present emergency, if not always, be measured by one yardstick, the value of their respective contributions to the public weal. Undoubted, neither is more valuable than the other ; the community needs both ; each gives of his best.

Yet we have been content to carry into war the silly distinctions which unfortunately were allowed to develop in peace. I suppose a specialist in medicine is one who is content to subject himself to relative and transient penury in order to equip himself with qualifications and techniques, which later, in exercise, will yield high financial recompense and social prominence. The generalist on the other hand, is one who earns as he learns. In peace, in our Society, by the nature of things, there was room for fewer specialists than generalists and so, since we too commonly assess the value of things by reference to their relative rarity, we paid the specialist more. In the organization for war when every man is required to specialize, that is to say, to become supremely good in a limited field, spurious peace distinctions might be expected to be broken down. But this is far from being the case.

For reasons that I completely fail to comprehend it has been accepted that the medical man who cares for the whole individual is of less worth than is he who tends to his throat or to his eye, or whose knowledge of human and social biology is limited to his microscopical acquaintance with bacteria. Anyone who knows so much of the arts of medicine and of man mastership that he can help keep 1,000 men contented and comfortable, stands every chance of being regarded lightly by higher authority ; but any youth with the ink on his specialist diploma not yet dry has been hailed as the profession's most precious gift to the Services and has been rewarded in three ways, being given high rank, specialist pay and, above

all, the privilege, denied to all others, of cultivating during the war the very techniques by the exercise of which he will, when peace returns, earn his lavish livelihood.

The fault for this, and it is a grievous fault, lies largely with us. We inside the profession have encouraged the development of the entirely false notion that the function of the University Medical Schools is the mass production of the general practitioner—that is what everyone is supposed to be on graduation, and if anyone, being ambitious, wishes to become something better he must put in another two years or so of study and take a higher degree. I maintain that two years in general practice spent as earnestly as are two years for a D.P.H., for example, are followed by as great or as even greater development. We are wrong, utterly wrong, in depreciating the quality of the service that the generalist in medicine gives to Society.

If I remember aright it is usually accepted that there are three kinds of antisocial acts, sins of omission, of commission, and of emission. We, as a profession, are guilty of sins of the second kind. I should have thought that there was enough intelligence among us to have devised a scheme according to which the yardstick used in the giving of commissions would have been that of age. Age is the only measure of experience and of social responsibility that can be used at all generally. As things are, young men with diplomas have entered the Services to find that their incomes have been doubled whilst older men with families and of wide experience are required to make most unequal sacrifices, and so the seeds of discontent, which will grow into weeds that will choke true patriotism, have been sown.

But enough of carping criticism from me. Of the spit and polish for which the Army is renowned, I prefer the polish. It is true to say, I think, that the mistakes that we have made have been recognized and will not be repeated. To make mistakes is not blameworthy; not to profit from these is in these days completely criminal. May I turn now to the other and more important aspect of this topic? What of the future?

When I look around the medical services as they are even now taking shape I marvel at their comprehensiveness and their promise of completeness, at the simple beauty of their design and at the efficiency of their functioning. And I am led to wonder whether we as a Society can ever be content to let this organization disintegrate when the war ends.

In the first place the war has called into being a mechanism which is being used for a comprehensive survey of the bodily and mental qualities of a very large section of the community. The recruiting boards are engaged in a stock-taking that can, if their findings are properly analysed, give us a starting point for all future medical policies. The real wealth of this country in peace as well as in war is to be found essentially in the healthiness or otherwise of its human population. These recruiting boards are disclosing defect and derangement before these have led their possessors

to the consulting rooms of the profession or to the out-patient departments of the infirmaries. Never before have we had such a magnificent opportunity for determining the incidence and distribution of healthiness in its various grades in our population. Furthermore, any defect which may have passed too easily through the sieve of these recruiting boards is quickly recognized by the regimental officer and non-commissioned officers and passes through the regimental medical officer on to the command medical specialists in a military hospital or in a (military) general hospital to be repaired or else returned to civil life by way of the standing medical boards. The Ministry and Department of Health should come to possess, as this war progresses, a great mass of information of the very greatest statistical importance. If this is properly used we shall be able to know exactly what are the outstanding problems facing our profession and thus we shall be able to plan for their solution. Surely it will not be denied that during peace as well as in war we need information such as this. If this be granted then it follows that in peace we need a mechanism, as precise as the present one, for the critical, co-ordinated, systematic collection of this information and for the exploitation of the knowledge that it yields.

May I now call your attention to the Command Medical Specialist Centre which is an important feature of the present military medical system. Of these there are many, but I will speak of what I know. Into the registry of the Military Hospital at the Castle nearby there flows a stream of some 4,000 out-patients every month. They have been sent in by the regimental medical officers for examination by the specialists. Of these there are specialists in surgery, medicine, psychiatry, ophthalmology and E.N.T. In addition there are the Command Laboratory and the Command Dental Centre. These constitute the population of a polyclinic and as I watch the working of this I am unable to avoid the conclusion that here in this city there is even now taking shape a model of the system which will be universally adopted in civilian medical practice in the near future. I do not suggest that this system is best for the doctor who flourished in our most imperfect society before the war, but that it is best for the community is, I think, a view that can be considered by the open mind. As things now are, the doctor discloses defect before it has been recognized, he challenges derangement whilst this is still slight, he smells out fears and anxieties before they have become obsessions, and behind him there is this team of specialists working in close contact and in complete harmony to give him aid. But, note this, if we in the Castle anatomize a man, sending his heart to one room and his mind to another for deep investigation, we return the whole man to his own regimental medical officer and to the environment whence he came. The specialists recommend, the generalist decides. This orientation of specialist and generalist is not yet complete, even yet the man who is concerned with the individual as a whole and in relation to his environment is too much inclined to treat the whole of a man according to the prescription of the specialist who has examined a part and that part

*in vacuo*. But this unbecoming modesty will surely disappear when the generalist has been encouraged to realize that he has a part to play that is equal in importance to that of the specialist.

I see no compelling reason to think that this war will evoke any large and sudden advances in general medicine and surgery but you will not have overlooked the significance of the institution of special hospitals—for effort syndrome, for head injuries and such-like—which are not merely hospitals in the ordinary sense, but are, in fact, research centres brought into being by the war. In the field of psychiatry, however, I do expect great advances and for two reasons. In the first place, this is a young and rapidly expanding branch of medicine which is being nourished because of its great promise and usefulness to society, and secondly, because an organization for its practice and extension has already been brought into being by the war. These are the factors which lead to the rapid development of a branch of medicine, a recognition of its potential value on the part of society and the construction of an organization for its systematic prosecution.

It is now fully recognized that a man's fitness for service is largely determined by his mental qualities, and the Army which formerly thought itself complete if it had its complement of chiropodists now has added to itself a team of psychiatrists, and as a result our chances of victory are all the greater. If this is necessary and desirable in war, surely it is even more necessary in peace that these healers of the mind shall have their prominent place and shall be as readily available to the community as they are now.

Finally, let us look for a moment at the organization of the laboratory and research services which have been so greatly amplified and extended. The Medical Research Council, in respect of its power and of its usefulness, is never so important in peace as it is in war. That this is so is but another instance of the fact that the rate and the direction of research are determined by the expressed needs of society. I merely present the view that there must be no slackening in research with the return of peace, for the community will stand in more urgent need of new knowledge than it does even now. War has this advantage over peace : during war new knowledge is exploited and applied much more quickly and much more thoroughly.

No one will deny that the Emergency Bacteriological Service and the Blood Transfusion Service and such-like should be regarded as weapons to be laid aside when our armour is doffed : these, being modified, should certainly be incorporated into the services which the profession will provide in peace. The war has sharpened all our tools and, being carefully tended, can be used later for creative work, for the building of a new social order.

I have attempted, I hope successfully, to provoke you to disputation. The view I have endeavoured to present is that the continued evolution of the profession, as an instrument of society, is a process that will and must proceed ; that the trend of this evolutionary development is already clearly to be seen and that the effects of the war upon this development are such

as to quicken its pace. We, as a profession, recognizing the direction of this process, can increase its rate or attempt to retard it.

In a former age I was garbed in the sombre role of a professor of genetics and not in the motley of a prophet, and what I see is still viewed through somewhat dusty windows of a laboratory. Even so, it seems to me that inevitably there must come into being a clear recognition of the fact that the organization of the medical profession for war is infinitely better than was its very partial and imperfect organization in peace ; that we are now able, thanks to this organization, to give to the community a much better service, and that this being so, when peace returns the present organization must therefore continue.

But the new conditions will demand a new type of professional man, and therefore a new type of education. The future equivalent of the regimental officer, the generalist, will be a specialist in disease prevention and disease detection, the polyclinic will be the place where disease is removed and individuals are repaired. All aspirants to medical degrees will need to be such as can respond ardently to the appeal of a great ideal—that of taking a prominent and active part in the building of a new society in which healthiness of mind and body shall be regarded as a cardinal virtue ; in which a sense of serving humanity to the utmost of one's ability shall be one's chief reward. To wear the spiritual uniform of a doctor will in those days be a great privilege and an even greater responsibility.

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## AMENDMENTS TO THE MEMORANDUM CONCERNING THE USE OF SULPHONAMIDE DERIVATIVES

We published the Memorandum concerning the use of the Sulphonamide derivatives in an abbreviated form in the September number of the *Journal*.

Page 172. *Delete detail under "DESIGNATION OF SULPHONAMIDE COMPOUNDS AND CHOICE OF COMPOUND" and substitute :*

Sulphanilamide :	Supplied in tablets of 0.5 g.
Sulphapyridine :	Supplied in tablets of 0.5 g.
Sulphapyridine soluble :	Supplied as a 33 per cent solution (1 g. in 3 c.c.).
Sulphathiazole :	Supplied in tablets of 0.5 g.

The supplies of Sulphapyridine are not unlimited and every care should be taken to observe economy in the use of this drug. It is recommended, therefore, that sulphapyridine should be exhibited in the following conditions : gonorrhœa, cerebrospinal meningitis, pneumonia and pneumococcal infections, gas gangrene.

The use of Sulphapyridine Soluble for intravenous or intramuscular injection should be restricted to emergency treatment and a return to oral administration be instituted as soon as possible. The indications for the use of this special preparation are made in the text of the Memorandum.

Whenever the condition to be treated is known to respond equally well to Sulphanilamide and Sulphapyridine, the former drug should be employed.

Sulphanilamide should be the drug of choice in the prophylaxis of wound infections and the treatment of erysipelas and cellulitis, meningococcal carriers, wounds known to be infected with hæmolytic streptococci (*acute phase*), follicular tonsillitis and otitis media, *B. coli* urinary infections.

*Note.*—Sulphathiazole appears to be more active against staphylococcal infections than the other sulphonamides and little less effective than Sulphapyridine against meningococcal and gonococcal infections. Clinical experience with this drug is as yet too limited to allow its position to be established fully, but there appears to be general agreement as to the relative low toxicity and the absence of unpleasant sequelæ.

Sulphanilamide is inactive against all types of pneumococci except Type iii and has but little action on Staphylococci.

Page 177. "THE TREATMENT OF SUNDRY OTHER INFECTIONS." *Delete detail under "Staphylococcal Septicæmia : " and substitute :*

Sulphapyridine or Sulphathiazole are the drugs of choice. The course with the former preparation should be similar to that described for Lobar Pneumonia (page 176). The available clinical evidence suggests that sulphathiazole is rather more effective and as the exhibition of this drug does not commonly induce nausea or vomiting, it is to be preferred to Sulphapyridine for this condition. Although as much as 12 g. of Sulphathiazole may be administered in twenty-four hours, the optimum dosage is not yet decided.

## Editorial.

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### LIGHTING IN FACTORIES AND VENTILATION DURING THE BLACK-OUT.

THE Departmental Committee on Lighting in Factories has issued five reports. In September, 1938, the fourth report was submitted. It contained recommendations as to standards of lighting in factories, with a view to embodiment in Regulations under Section 5 (2) of the Factories Act, 1937. There is evidence that following the publication of this Report improvement in lighting practice resulted, and the recommendations provided criteria for the manufacturers of lighting equipment. Up to the outbreak of war regulations embodying the recommendations had not been made. At the request of the Home Office the Committee reviewed the position in the light of war conditions and then submitted amended recommendations appropriate to the present time.

At the commencement of the war means of preventing the emission of light during hours of darkness had in most cases to be hastily improvised and consisted mainly of the application of black paint or other opaque material to windows. This system not only caused permanent and complete elimination of natural light during the day, but also prevented opening the windows at night, resulting in inadequate ventilation and the production of conditions that were unsatisfactory and, where hot processes were carried on, often almost intolerable. Later, owing to the complaints of the workers there was a tendency to replace permanent obscuration by a system of shutters or blinds admitting natural light during the day, while preventing the emission of light during the hours of darkness.

When their report was written the Committee state that the position was as follows : In many factories in which no night work is being done the obscuring materials had been removed and pre-war conditions regained with the longer hours of daylight. Some factories remain permanently obscured. Where this is so, it is generally due to difficulties of camouflage design, or to special structural features, such as exceptional height or difficulties connected with control of shutters or blinds. The difficulties as regards ventilation have been largely met by additional mechanical means or by the provision of suitable light trap openings, enabling natural ventilation to be secured without the escape of light.

In most factories provision for the admission of some natural light is made. In this connection satisfactory conditions often result from the admission of a fraction of the normal amount. In most modern roof-lighted factories with a window area equal to 30 or 40 per cent of the floor area, it

is believed that 12 per cent (obtainable in such cases with permanent obscuration of about two-thirds of the window area) will normally allow ordinary work to be carried on during the day without recourse to artificial light.

Generally speaking, two features characterize industrial work in a large number of factories at the present time. In the first place, the work has to be done at high pressure and much greater strain is imposed on the worker. Secondly, owing to the prevalence of night-work, and overtime, the time spent under artificial light is far longer, even in factories which provide adequate natural light. In pre-war days, for example, a working day of 8 a.m. to 5.30 p.m., connoted the use of artificial light for about 10 to 15 per cent of the yearly hours of employment ; at present it is often 50 to 100 per cent.

The Committee were unable to find any evidence that prolonged or even continuous work under artificial light had any deleterious effect on health or safety, though it may be that at later stages such effects may be established. They considered that the present conditions are unnatural and new to the majority of the workers. They agreed that exposure to such conditions justified the maintenance of a higher standard of lighting than that previously recommended by them in the interests both of the workers and of increased production.

In a previous report a minimum illumination of a foot-candle at floor level for the working areas of factories was recommended. This minimum can no longer be regarded as generally adequate, and it was thought desirable to lay down a standard based on what is usually regarded as good illumination, enabling ordinary work to be done with ease and affording reasonable amenity to the workers affected. In factories generally, the Committee thought a minimum of 6 foot-candles at three feet above floor level should be attained. Reduction from this standard might be allowed in steel works and heavy engineering works, where overhead cranes and other obstructions necessitated the light sources being mounted at considerable height from the floor. Where the height of the light source exceeds 25 feet from the floor, the illumination must not be less than 2 foot-candles, and not less than 6 foot-candles where actual work is being carried on. The illumination will be measured in a horizontal plane 3 feet from the floor. For other factories, viz., glass works, works manufacturing photographic material, and electrical generating stations, in which the work is chiefly the reading of dials locally illuminated, it may be necessary to give the chief Inspector power to grant exemption when he is satisfied that the illumination is satisfactory in the circumstances.

As regards interior passages and access the Committee recommended that over all interior parts, through which persons employed are liable to pass, other than those in which persons are regularly employed, the illumination at floor level must not be less than 0.5 foot-candle. In some factories it was noticed that windows serving passages and stairways have been left permanently blackened or screened, with the consequence that persons



entering from workrooms in which natural lighting has been restored, find difficulty in seeing their way. Care should be taken to maintain adequate lighting in the parts referred to.

In respect of exterior employment passage and access, the Committee's previous recommendation of a minimum illumination of 0.1 foot-candle over open yards and other exterior parts of factories is no longer applicable owing to the Lighting Restriction Order. Considerable aid to movement, however, can still be afforded by the permissible street-lighting standard of 0.002 foot-candle, combined with whitening of curbs and obstacles. For work of national importance higher standards may be authorized by the Chief of the Police. The mere quantity of light is not the only factor in good lighting, and the effects of the blackout must be relieved by maintaining light colour throughout the interior parts in which persons are regularly employed. Glare is still present in many of the old factories, and the Committee recommend that where any light source in a factory is less than 16 feet height above floor level, no part of the source or fitting, having a brightness greater than 16 foot-candle per square inch, must be visible to any person whilst normally employed within 100 feet of the source, unless the angle of elevation from the eye to the source exceeds 20°. All sources of light in a factory must be provided with suitable shades of opaque material, and means must be taken to prevent discomfort or injury by the reflection of light from smooth or polished surfaces. Adequate means must also be taken to prevent the formation of shadows which interfere with the safety of, or cause discomfort, to any employed person.

Complementary lighting by means of sodium discharge bulb lamps or tungsten filament lamps in amber bulbs is not recommended and has been to a great extent abandoned. The Committee are convinced that the admission of natural light, even in small quantity, is of great importance, and this object can be secured by the provision of shutters or blinds enabling part of the roof windows to remain unobscured during the day.

Factory ventilation, if it is to be fully effective, must achieve not only a rapid removal of air impurities by air change, but a rate of air movement which will afford a sufficiently stimulating effect on the worker. No workroom, however lofty and spacious, will be a satisfactory place to work in, unless suitable air movement is maintained. Experience has shown that the air in the average workroom should in ordinary circumstances be changed six times an hour. In winter, a lower rate may have to suffice, because of special problems associated with the heating of the premises. In summer, a lower rate should not be tolerated. An adequate supply of air through windows and other ventilators must be maintained without fail. More frequent changes than ordinarily required will be necessary if combustion or manufacturing processes vitiate the atmosphere. In some rooms, where air movement is insufficient in certain parts, suitably-placed circulating fans of the slow-moving type will overcome the defect. Orbit and oscillating fans can also be employed with advantage. Other useful means are

“wafters” fitted on shafts which move the air rapidly in their immediate vicinity. These special methods present no difficulty during a blackout and are often of special value in relieving discomfort from a high temperature or a high humidity.

Natural ventilation, as induced by winds and air currents, will not suffice unless openings of adequate size and suitably arranged are provided.

In designing devices (light traps) for intercepting light at ventilator openings, almost any air passage with two right-angle bends will be in some degree effective. The air flow must not be restricted at any point by making the passages too narrow or too abrupt. However carefully designed a light trap will hinder the flow of air to an appreciable extent, possibly by as much as 50 per cent. Openings which normally provided satisfactory ventilation may, therefore, prove inadequate in a blackout and additional means of ventilation will then be needed. In large workrooms plenum systems are usually employed, and supply the air to rooms under slight pressure; the air passes out through windows, doors and other openings. In some factories these openings are made ineffective by blackout measures and care should be taken that a sufficient number of suitably placed outlets, fitted with light traps where necessary, are kept in use for releasing the air. It is essential for the working of the system of extraction fans, that provision should be made for the air to enter freely. Inlets of large overall area are necessary; they should be on the side of the room opposite the fans. The air should enter at such a height as to produce sufficient air movement at the working positions without creating excessive draughts. The inlets should be at a relatively low level, particularly if the fans extract overhead. If the extraction is at a low level, as is often desirable, the inlets may be higher.

Ventilating appliances are often put out of use in cold weather if there is insufficient warming. The heating arrangements should be such as to secure that both a reasonable temperature and adequate ventilation can be maintained. Plenum systems provide for this. In other cases, the pre-heating may be effected by radiators or other heaters placed at air inlets.

Unit heater systems have been adopted in many factories. The heaters are placed at high level, and their use does not encumber the floor space with the pipes, radiators, etc., of a heating system. The heaters consist of elements heated by hot water, steam, electricity or gas, and an electrically-driven fan for driving the air through the heater. By means of adjustable louvres, the air is driven in the required direction. Unit heaters are in some cases, though not usually, connected to fresh air inlets. During the summer when heating is not required, the heater fans can provide effective air movement throughout the workrooms.

Unduly high temperatures must be avoided; closing of the ventilators may lead to over-heating and cause discomfort in the workrooms if suitable regulating appliances are not available.

Excessive temperatures from other causes, and excessive humidity

should be prevented. Auxiliary ventilating appliances are most useful in such cases.

With regard to exhaust ventilating arrangements provided for the removal of dust fumes or steam, it will be appreciated that the efficiency of such arrangements may be adversely affected if general ventilation is interfered with for blackout purposes by closing or obstructing ventilators through which the fresh air supply enters the workrooms in ordinary circumstances.

The fourth report contains drawings of light traps at ventilator openings. The component parts are generally of small area; sheet iron, timber, asbestos sheet, and impregnated roofing felt can be used without special treatment, but plywood, millboard and multi-layered paper or card products, will require suitable treatment with impervious material to prevent the penetration of damp. The interior surfaces of all light trap ventilators, including constituent baffle plates and louvres should be coated with *mat black* paint, or its equivalent, in order to minimize the possibility of transmission of light by reflection and diffusion.

It is well known that work which involves discrimination of detail, such as engraving, typewriting and proof-reading, should only be done under a high standard of lighting. The Committee have not been able to lay down definite standards for fine classes of work, but they print as an appendix the code recommended by the Engineering Illuminating Society. This code of lighting ranges from 2 to 4 foot-candles, where casual observation but not specific work is done, to over 50 foot-candles for precise work. For fine machine work, proof-reading, and type-setting, a standard of 15 to 25 foot-candles is recommended. If all their recommendations are given statutory force there may be some difficulty in getting the requisite equipment to alter the present lighting arrangements in many factories. The Committee consider that it would be better if compliance with regulations were not pressed in factories not doing essential war work, provided the existing conditions are reasonably satisfactory. They add that to obtain the best results in lighting, the alterations or new installations should be supervised by qualified illuminating engineers, and that such persons over an appropriate age might be included in the list of reserved occupations.

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## Clinical and other Notes.

### AVULSION OF STOMACH FROM DUODENUM.

BY MAJOR IAN FRASER,

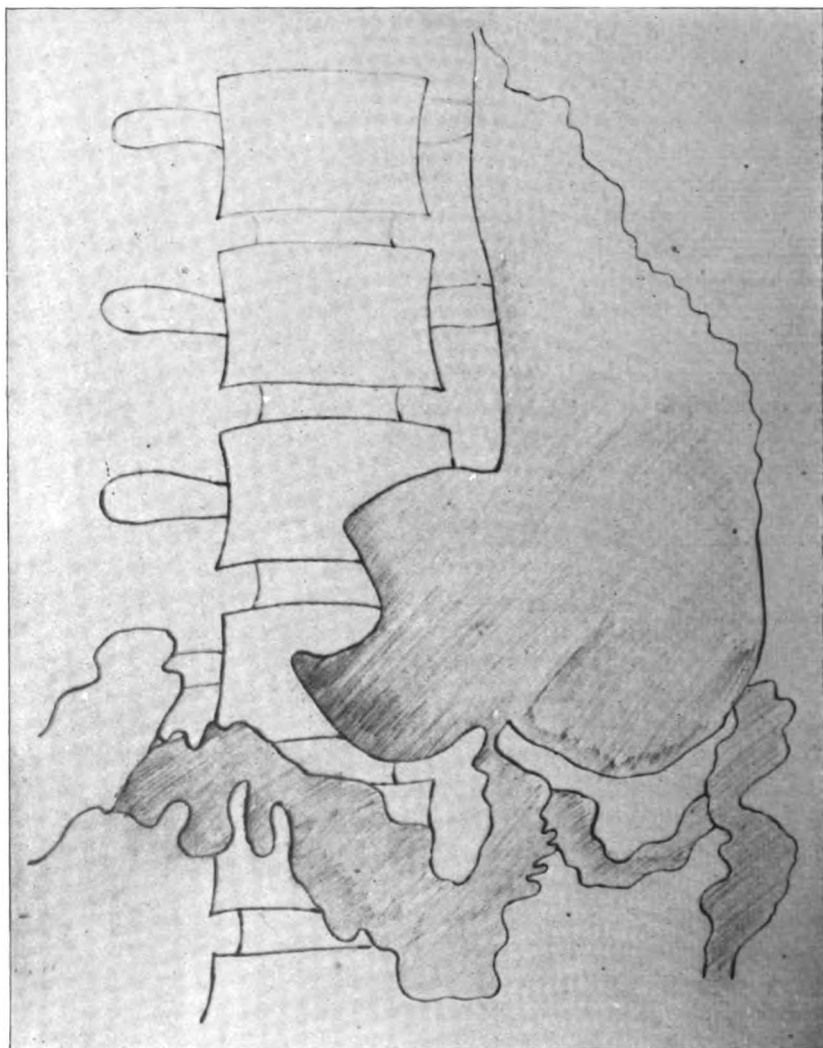
*Royal Army Medical Corps.*

It is a well recognized fact in surgery that when a separation due to trauma takes place it usually does so at the junction of the mobile, and fixed parts—a tendon gives way at its junction with the muscle belly: a fissure in the anal canal occurs posteriorly where the sphincter is fixed towards the point of the coccyx. In general crushes to the abdomen the gut is found to tear where a mobile portion joins a section which is tightly adherent to the posterior abdominal wall, e.g., duodenum and jejunum, terminal ileum, etc. Even Hitler realized this fact when he directed his attack at Sedan, the weak point of junction of the fixed Maginot Line and its mobile western continuation. The following case is worth reporting, firstly, because it supports these facts, and secondly on account of the unusual situation of the severance.

Driver S., aged 21, R.A.S.C., was on night manœuvres on July 31. His lorry was stationary in a field and he was leaning over the near front mud-guard, with his head under the bonnet, investigating the engine. Suddenly a 5-ton lorry reversed into him, crushing him against the sharp edge of his own mud-guard. He collapsed at once and it was clear that he had suffered a severe abdominal injury. When seen four hours later at hospital his abdomen was rigid and he had considerable pain in his left shoulder. Breathing was short and of the “cog-wheel” variety. Liver dullness was still present (how useless this sign so often is!) and no dullness could be detected in the flanks (this also is difficult to be dogmatic about as no one knows the normal for each particular individual). The pulse was 96 and the temperature 97°F.

A diagnosis of ruptured viscus, probably in the upper abdomen, was made and the patient operated upon at once. The abdomen was opened by an incision meant to be mid-line and gas escaped immediately to confirm the diagnosis; this was followed by blood, much fluid and green peas—the latter floating about, green flecks upon a reddish background, gave quite a mosaic effect. When this was swabbed away we discovered two large, open tubes with everted mucosa. One was the pylorus with a fringe, about a quarter of an inch deep, of the first part of the duodenum, and the other, more deeply placed and already sinking away into the flank, was the other end of the duodenum. Just for one second the thought of trying to reconstitute the gut was considered. It was, however, quickly seen that this was out of the question; the pyloric fringe was insufficient; absence of peritoneum on the duodenum made primary healing almost impossible. There

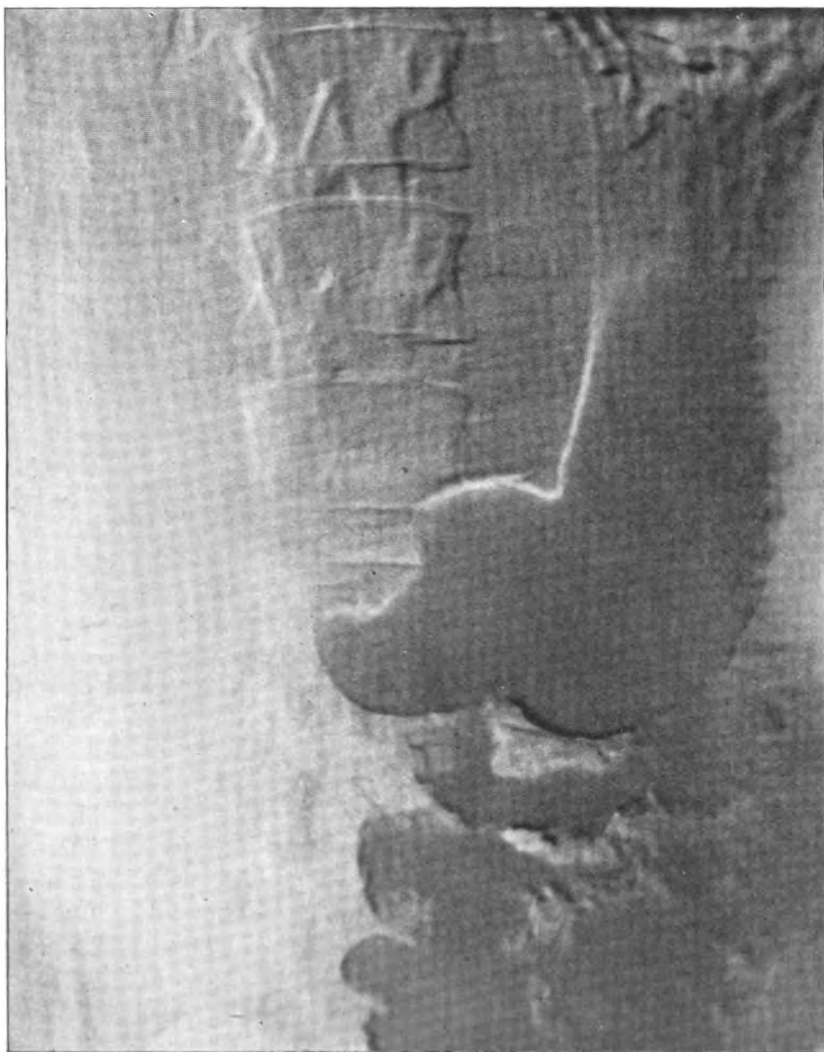
arose the immediate problem of resting the new suture line from peristalsis and gastric contents, and the possibility of a stricture in later life was realized. So each end was closed with considerable difficulty and a large omental graft placed over each to enclose it—like a parcel wrapped up in



Outline sketch showing emptying of stomach through gastro-enterostomy, and also invaginated pylorus.

paper—and the closed stomach was drained by means of a posterior gastro-enterostomy. What a very unsatisfactory area to deal with the second part of the duodenum really is! It is most difficult of approach to the surgical Mahomet and yet, unlike the mountain, refuses to be mobilized

to come forward to him. At this stage the blood-plasma apparatus was well under way under the direction of Major Crozier. The ease with which, in the middle of the night, blood transfusions can now be given is a great asset to patient, surgeon and all concerned, and it is a pleasure to acknowledge



Radiograph taken fourteen days later showing filling defect due to invagination of pylorus.

here the help which the War Office is giving through this service. The free abdominal blood and left shoulder pain suggested a splenic tear and, before closing the abdomen, we confirmed this, finding a large, V-shaped tear going half way through the spleen. However, as bleeding seemed to have stopped, possibly as a result of the plasma, it was thought that this might

heal successfully and so the spleen was left. The abdomen was closed and a drainage tube left through a separate stab wound to leave an exit for a possible leak and egress for any further peas. Convalescence was uneventful. The patient was able to take fluids in a normal manner within twenty-four hours or so. No further transfusion of blood or saline was necessary. The only untoward complication of any sort was some superficial sepsis in the abdominal wound.

This case is of interest as it exemplifies the well-known fact that gut usually tears at the junction of fixed and mobile portions—although the other explanation might be that it is the gut which is pushed forward by the vertebral column that bears the brunt of the injury as compared with the other portions which can recede into the safety and protection of the para-vertebral gutters. There have been very few papers written exclusively upon the subject of abdominal crushes; the majority have dealt with wounds of the abdomen, chiefly war injuries. One of the most comprehensive appears in the *Proceedings of the Royal Society of Medicine*, vol. 2, page 1, by the late Sir James Berry. His material was collected from the reports of the ten large London teaching hospitals, over a period of fifteen years. It comprised in all 132 cases. The causation was found to be in almost all cases, a “run-over” accident, a squeeze or crush, a blow, a kick or a fall. Fifty-one out of the 132 were “run-over” cases; 24 were injuries to the duodenum, 12 to the large intestine and 96 to the small intestine. It was difficult to ascertain whether the mechanics of the injury resulted from crushing, bursting or traction. He quoted the work of Hertle, who did some experimental work on the rupture of the gut, using living animals and human cadavers, and who proved that with crushing injuries the soft coats (mucous membrane and muscular) gave way first and peritoneum remained intact—occasionally perforating at a later date—while with bursting injuries it was the peritoneum which gave way first. Usually (in 75 per cent of the cases) the tear is transverse to the long axis of the gut. Of the 132 cases there was a gross mortality of 115, and of the 24 cases occurring in the duodenum there were no recoveries—due, presumably to the fixity of the organ, to the lack of peritoneum and to its inaccessibility. On the other hand, as regards infection, the prognosis should be much better than lower down the alimentary canal. Of the 24 cases occurring in the duodenum many were found with the injury at the duodeno-jejunal flexure and in the third part (where it crosses the projecting spine). There have been very few cases in the literature of complete avulsion of the stomach from the duodenum, as described above. The condition is a rare one and the patient must consider himself lucky to have recovered, especially with his condition complicated by a ruptured spleen.

I wish to thank the patient who, despite the severity of his surgical experiences, has made a splendid recovery. Also my Commanding Officer, Lieutenant-Colonel Booth, D.S.O., whose encouragement and optimism helped to make the case a success and whose stimulus prompted me to write this short note.

POSTURE DURING CYSTOSCOPIC EXAMINATIONS.  
DESCRIPTION OF A NEW PATTERN OF LEG SUPPORT

BY JOHN EVERIDGE, O.B.E., F.R.C.S.,

*Honorary Consulting Urological Surgeon, Queen Alexandra Military Hospital,  
Millbank, etc.*

IN the performance of cystoscopy the position of the patient on the operating table and especially the placing of his legs are important factors in facilitating the technique. These factors are even more important when the examination is made under local anæsthesia. I prefer the lithotomy posture as I can then sit in comfort opposite the perineum and can perform manipulations with greater steadiness and less fatigue than when straining neck and back over a patient in full recumbency. I admit, however, that it is easier to pass rigid instruments up the male urethra when the patient's legs are in the horizontal plane.

In the semi-lithotomy position I use, the legs are raised to an angle of 45 degrees and fully abducted. This, to the conscious patient, is perfectly



comfortable so that he is able fully to relax. By general muscular relaxation he is better able to relax the perineal muscles and so make easier the manipulations of the cystoscope; a spasm is less likely to be set up, and the local anæsthetic is thereby assisted.

Tables designed for urological work provide this position, but with most general surgical tables, if the orthodox vertical posts and ankle slings are used, the hips will be hyperflexed and a position is provided which is bad for three reasons: it is uncomfortable, the normal curves of the urethra are exaggerated and the ureteric orifices are less easily seen and manipulated.

In 1932 (*British Medical Journal*, 1932, November, 973) I designed a fitting adaptable to any standard operating table, which has now been adopted by the Army. The accompanying illustration is self-explanatory.



The device consists of a metal support and a calf-hammock for each leg. The supports have vertical and curved sections surmounted by hooks to hold the rings of the hammocks. The vertical sections (hexagonal) are received in the slots with which every table is equipped and are gripped by tightening the screws on to a flat surface in such a position that the curved sections are thrown out at right angles to the long axis of the table. The hammocks, fitted neatly to the calves, extend up to just below the bend of the knees; they must be smoothed out flat. The height of the supports will depend on the length of the patient's legs. The buttocks usually do not reach lower than 4 inches from the bottom of the table. The "bowed" metal leg supports can be used equally well in combination with the double loop foot sling, for maintaining the patient in the lithotomy position.

If there is difficulty in passing the cystoscope when the legs are in this position, they are dropped to the horizontal by releasing the screws and allowing the supports to descend. When the cystoscope is in place the legs are easily raised by the reverse process.

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### CEREBRAL INFLUENZA SIMULATING EARLY CEREBROSPINAL MENINGITIS.

BY LIEUTENANT GEOFFREY N. PATTISON, M.B., B.S. DURHAM,

*Royal Army Medical Corps.*

THE following is an account of twenty consecutive cases of a type of influenza which has arisen recently in two nearby but entirely separate military units. In military camps or billets where there is a large number of young men, many recently having environmental and occupational changes, associated with that degree of overcrowding sometimes incidental to military life and in addition having that extra burden of vigilance and fatigue due to the greatly increased activity of the war. These are all factors which lower resistance to infection. In particular cerebrospinal meningitis is one of the infections to which these factors apply.

The twenty cases of influenza were remarkable in the similarity of their signs and symptoms and also with those of cerebrospinal meningitis in its earlier stages. In general these were pyrexia, headache of varying degrees of severity, in some cases most intense, and marked malaise. Some cases in addition showed photophobia and a scarlatiniform rash. The influenza was in all cases confined to the cerebral type; none of the other involvements of the throat, nose or chest was observed. A detailed list of the men is given.

In the detailed analysis it will be noticed that the temperature within twenty-four hours of onset was high; in 60 per cent all of the men had fever of 101°F. and over. The initial rise was sudden and subsided slowly. The pulse-rate as a rule was high also and although it is usual to regard a slow

pulse as a characteristic sign of cerebrospinal fever I have been informed that in true cases of the disease, which have arisen recently in this locality, the pulse-rate was uniformly high. Muscle and joint pain is a common feature in many febrile conditions and in itself is of no special significance ; 90 per cent of the cases showed this feature, but it is interesting to note that in many it was referred generally to the back of the neck, in some to the back itself and in two cases to the stomach.

Case No.	Temperature within 24 hours of onset	Pulse-rate within 24 hours of onset	Muscle and joint pains	Photophobia	Headache	Rash	Rigors	Dilated pupils	Neck rigidity	Other remarks
1	102.8°	82	—	—	+++	Slt.	—	+	+++	Double Kernigs, vomiting.
2	104.0°	96	+	+++	+++	++	+	+	+	Slt. Delirium. Extrasystoles.
3	100.8°	116	+	—	++	Slt.	—	+	—	
4	100.0°	112	+	—	++	—	—	—	+	
5	99.8°	100	+	—	++	—	+	—	+	
6	100.0°	100	+	+	+	—	++	+	—	
7	102.0°	90	+	—	++	—	+	—	—	
8	103.2°	96	+	+	++	—	+	+	+	
9	99.8°	84	+	—	+	—	—	—	+	
10	100.8°	98	+	+	+	—	+	—	+	
11	99.6°	98	+	—	++	—	Slt.	Slt.	—	Vomiting.
12	102.2°	86	+	+	+++	+	+	+	—	
13	013.0°	140	+	—	++	+	+	+	—	
14	103.0°	98	+	—	+++	+	+	+	—	Extrasystoles.
15	102.5°	100	+	—	++	Slt.	+	+	—	
16	104°	90	Slt.	—	++	+	—	+	—	Epistaxis. Retinal engorgement.
17	104.0°	80	++	++	+	—	+	+	—	
18	102.2°	76	++	++	++	—	—	+	—	
19	99.6°	74	+	+	++	—	—	+	—	
20	103.2°	98	+	+	+++	Slt.	+	+	—	

Headache was the most outstanding feature in every single case. It was in the main referred to the orbit and to the supra-orbital region. In the early stages the headache was most difficult to relieve by the usual treatments. 45 per cent of the men had an initial small petechial rash involving the head, neck and thorax. Dilated pupils were present in 60 per cent, this being of no special significance ; no case showed any tendency to squint

The device consists of a metal support and a calf-hammock for each leg. The supports have vertical and curved sections surmounted by hooks to hold the rings of the hammocks. The vertical sections (hexagonal) are received in the slots with which every table is equipped and are gripped by tightening the screws on to a flat surface in such a position that the curved sections are thrown out at right angles to the long axis of the table. The hammocks, fitted neatly to the calves, extend up to just below the bend of the knees; they must be smoothed out flat. The height of the supports will depend on the length of the patient's legs. The buttocks usually do not reach lower than 4 inches from the bottom of the table. The "bowed" metal leg supports can be used equally well in combination with the double loop foot sling, for maintaining the patient in the lithotomy position.

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15	102.5°	100	+	—	++	Slt.	+	+	—	
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18	102.2°	76	++	++	++	—	—	+	—	
19	99.6°	74	+	+	++	—	—	+	—	
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but in some the power of convergence was poor. Photophobia was present in 45 per cent and was fairly severe in three of them. In 35 per cent neck rigidity was present but not markedly so; in one case it was severe and forced flexion caused a great deal of pain. In this particular man, Kernig's sign was positive on both sides; no other physical signs than those noted above were found.

Case 2 deserves special description. This man reported sick complaining of feeling out of sorts and of headache for four days. His temperature was 104°F. and pulse 94. The head and neck showed a scarlatiniform rash. Photophobia was marked and conjunctivitis was present. Kernig's sign was negative. He was treated as an influenza for forty hours, but at the onset of a mild delirium he was sent to hospital as a suspected cerebrospinal meningitis. On admission a lumbar puncture was done at once. The fluid was clear, not under pressure and no organisms were found. The diagnosis was not made for some little time but he was eventually diagnosed as a cerebral influenza. This case in particular shows the difficulty in differentiating between the two conditions without special investigation.

Roughly one-third of the cases received M & B 693 as the greater part of their treatment and the remainder were treated with mist, aspirin and quinine with Dovers powder at night. These cases recovered more quickly. The course of the illness was short and the recovery quite uneventful.

#### CONCLUSIONS.

Twenty cases of cerebral influenza are described. It is noticed that the early signs and symptoms show a great similarity to those of early cerebrospinal meningitis, especially when occurring epidemically and in military life. The importance of differentiation is great.

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### Current Literature.

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**BUTTERFIELD, C. T. Some Functions of Bacteria in the Purification of Polluted Water. *J. Bacteriology*. 1940, v. 39, 527-33.**

The functions of bacteria in the purification of polluted waters are the same regardless of the degree of pollution. Experiments were carried out with dilute media or moderately polluted water having a 5-day Biochemical Demand of 6.0 parts per million, and with concentrated media or grossly polluted waters having a B.O.D. of 100 parts per million or more.

In the slightly polluted waters it was found that the dissolved oxygen was not used in the absence of bacterial activity. Bacteria, when introduced, increased rapidly to a maximum and oxygen was utilized at a rapid rate. Protozoa introduced failed to grow in the absence of bacteria. Bacteria

adsorb the organic matter, concentrate it and build it up into bacterial cells which are then available as food for protozoa.

In grossly polluted waters, mixed flora and fauna were present, and the resulting bacterial growth was colonial or flocculent. These massed growths contain huge numbers of bacterial cells and are able to carry on adsorption and oxidation very rapidly. No such floc-forming organisms were obtainable in dilute media or slightly polluted waters.

E. WINDLE TAYLOR.

*Reprinted from "Bulletin of Hygiene," Vol. 15, No. 9.*

BUSWELL, A. M., & SUTER, M. **A Study of Floc-forming Organisms in Chlorinated Water Supplies.** *J. Bacteriology.* 1940, v. 39, 583-7.

Floc-forming organisms are found in districts such as Illinois where the water contains unoxidized iron, sulphur, ammonia or other substances likely to affect nutrition. The infection first appears when the water is brought to the surface from a well and discharged into a reservoir. A sludge is formed which, on microscopical examination, is found to be composed of zooglœal masses of capsulated cocci or short rods having a diameter of from  $0.3\mu$  to  $0.5\mu$ . Larger bacteria, ciliata, nematodes and crustacea are found embedded in these masses.

Iron has been ruled out as the main cause of the floc formation, and the author showed that ammonia and methane may be used as sources of energy by the organisms. Larson (1939) reported that ammonia and dissolved oxygen diminish as water passes through a main, and there is a corresponding increase in the nitrite and nitrate content of the water.

The organisms may be isolated by rendering the floc extremely alkaline (pH 10-12), followed by cultivation on special media. Winogradsky's solution without the magnesium sulphate is recommended. [The organisms appear to belong to the Nitrobacteriaceæ, probably being species of the genera, Nitrosomonas, and Nitrobacter.]

Experiments with bactericidal agents show the organisms to be very resistant to chemical attack.

Methods to starve the growth by ammonia elimination were unsuccessful probably because other growth-promoting agents were introduced at the same time. "At present our tap water is being passed through a filter of katadyn silver which seems to furnish a sterile effluent after fifteen minutes contact." It appears that new methods of water treatment will be required to deal with this problem.

E. WINDLE TAYLOR.

*Reprinted from "Bulletin of Hygiene," Vol. 15, No. 9.*

## Reviews.

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**ACUTE INFECTIOUS DISEASES.** Third Edition. By J. D. Rolleston, M.A. M.D.Oxon, F.R.C.P.Lond., F.S.A., and G. W. Ronaldson, M.D. Glas., D.P.H.Oxon. London: William Heinemann (Medical Books), Ltd. 1940. Pp. x + 477. Price 17s. 6d. net.

In the preparation of this, the third edition of his well-known treatise on infectious diseases, Dr. Rolleston has again obtained the collaboration of Dr. G. W. Ronaldson, who is largely responsible for much that is new, including two interesting chapters dealing with erysipelas and isolation methods.

No less than eighty-nine of the total four hundred and seventy odd pages of the book are devoted to a study of diphtheria in all its aspects, a subject to which Dr. Rolleston has always paid much attention. The Schick test is fully described as are the various prophylactic measures now in vogue, including passive and active immunization. Serum therapy is also very fully and ably dealt with.

The tremendous advance in the treatment of cerebrospinal fever which has followed the almost universal change-over from serum therapy to drugs of the sulphonamide series is, perhaps, hardly sufficiently stressed but will doubtless receive more notice in future editions when, in the light of further experience, the results from such therapy can be more justly assessed.

A good account is given of typhoid fever, a disease which is of perennial interest to all R.A.M.C. officers, during both peace and war. "A higher percentage of mistakes in diagnosis occurs in typhoid fever than in any of the acute fevers admitted to fever hospitals." This contention one can well believe, as evidence of which the authors remark that "during the year 1922 no less than 46.4 per cent of cases admitted to the M.A.B. hospitals as typhoid fever were found on admission to be suffering from some other disease."

Amongst clinical signs of importance in this disease is mentioned absence of the abdominal reflexes "which are impaired or lost in a very high percentage of cases of enteric fever during the acute stage." Amongst bacteriological aids to diagnosis great importance is attached to the Widal reaction, especially the more recent modifications including the Vi agglutination test, the description of which includes a note on recent work by Boyd and Bensted, both well-known members of our Pathology Directorate. In the section dealing with the treatment of enteric group fevers one is glad to see that the authors are in line with modern practice when they recommend a less completely fluid diet than was at one time considered safe or desirable; and, although they consider that milk should still form the basis of the diet, such extras as eggs, junket, mashed potatoes, apple sauce, rusks, chocolate, and thin bread and butter may be added at an early date. A liberal supply of vitamin C in the form of sweetened fresh fruit drinks is also advocated.

An interesting chapter on typhus fever, another disease of special and often melancholy interest to all medical officers in war-time, deals chiefly, as is natural in a manual on acute infectious diseases, with epidemic louse-borne typhus. In their description of the vectors of this very infectious malady the authors still refer to *Pediculus corporis*, *P. capitis*, and, though not as a vector, *P. pubis*. The more modern designations of these dangerous pests are *P. humanus corporis*, *P. humanus capitis* and *Phthirus pubis*.

In a historical note dealing with the typhus group the following appears : " It is, however, a remarkable fact that owing to the *scrupulous cleanliness* (the italics are mine) of the Italian troops not a single case of typhus occurred among them in the Italo-Abyssinian campaign of 1935 although there were at least 20,000 cases amongst the Abyssinian troops (Castellani)." I wonder!! Reference is made to MacArthur's paper on " Old-Time Typhus in Britain."

The distinctions between the several varieties of endemic (flea-, tick-, and mite-borne) typhus are by no means clear, but the authors are in error, I think, when they speak of Brill's disease and murine typhus as being synonyms for the same disease. The generally accepted view is that the two diseases are closely allied but distinct and transmitted by different vectors ; the former being an attenuated non-infective stage of louse-borne typhus, whilst the latter is transmitted by the rat flea, *Xenopsylla cheopis*. The possibility that a mutation from murine to epidemic louse-borne typhus may take place under certain little understood conditions is still *sub judice*.

In the section dealing with the treatment and nursing of typhus cases the remark is made that " if *delousing* (lousing, according to MacArthur is a better word) has been effectively carried out, the nurse need not fear any risk of infection." This statement is, of course, only true if steps have been taken to sterilize the faeces of infected lice wherever they may be—a by no means simple task. The mere removal of infected lice is not, unfortunately, sufficient.

Short chapters describe those somewhat elusive, one might almost say nebulous, diseases, the fourth disease of Clement Dukes and fifth disease (erythema infectiosum).

It is noted with interest that daily applications of a saturated solution of potassium permanganate are still considered the best topical applications for smallpox.

A full and interesting account is given of vaccination and of the nervous sequelæ which occasionally follow this procedure. The recently introduced subcutaneous and intracutaneous routes for the introduction of calf lymph are also described and discussed.

The book is brought to a close by an interesting chapter on isolation methods which should make a special appeal to members of our Hygiene Directorate.

The book is well printed ; few mistakes have been detected ; and there is a very full bibliography at the end of each chapter.

S. S.



**THE SOLDIER'S HEART AND THE EFFORT SYNDROME.** Second Edition. By Sir Thomas Lewis, C.B.E., F.R.S., M.D., D.Sc., LL.D., F.R.C.P. London : Shaw and Sons Ltd. 1940. Pp. viii + 103. Price 8s. 6d. post free.

A second edition of Sir Thomas Lewis's well-known treatise on the soldier's heart is welcome at this time and may justly be classed as a "war classic."

The importance of the subject-matter may be gauged from the fact that 44,000 cases of effort syndrome (a not wholly satisfactory title for a condition which has little to do with effort) drew pensions during and after the last war.

A point of considerable interest to recruiting Medical Boards is that 43 per cent of all cases of effort syndrome during the last two years of that war had symptoms on enlistment.

It therefore behoves all those concerned in the medical examination (both on first enlistment and during and after the subsequent training period) and care of troops to be in a position to diagnose and to treat effectively young soldiers suffering from this elusive syndrome in its early and more amenable stages, and thus to prevent the development of the severer and more crippling grades of the disease which may well necessitate prolonged hospitalization or even invaliding.

Needless to say, this carefully revised standard work by an acknowledged authority will help them greatly in this difficult task.

S. S.

#### **TWENTY QUESTIONS ON GONORRHOEA.**

V.D. Bulletin No. 93, issued by the U.S. Public Health Service, commences with the apt caption "Gonorrhœa is a disease not a disgrace." This little brochure contains all the information that the average layman needs and sets out in plain language what gonorrhœa is, how acquired, how it affects people, how it is cured, and how it may be controlled. When the man in the street realizes that "more people suffer from gonorrhœa than from any other serious disease," perhaps he will begin to understand its importance.

The type is clear, the language plain and the illustrations arresting; the price is five cents. Many a medical man could learn much from this small publication.

**GROVES AND BRICKDALE'S TEXTBOOK FOR NURSES. ANATOMY, PHYSIOLOGY, SURGERY AND MEDICINE.** Sixth Edition. By E. W. Hey Groves, M.D., B.Sc., M.S., F.R.C.S., and J. A. Nixon, C.M.G., M.D. Cantab., F.R.C.P. Lond. Oxford University Press. London : Humphrey Milford. 1940. Pp. xxx + 682. Price 21s.

A new (sixth) edition of this standard textbook for nurses is of special importance and doubly welcome at the present crisis in our affairs when the need for skilled nurses has never been more urgent.

It may be said without fear of cavil that any nurse who, during the course of her training, has been able to "read, mark, learn, and inwardly digest" the mental pabulum provided within the covers of this book will be, as far as the theoretical part of her training is concerned, excellently equipped for any nursing task that may lie before her.

S. S.

**BADGES AND EMBLEMS OF THE SERVICES.** London: N.A.G. Press Ltd. 1940. Pp. 64. Price 6d.

This booklet aims at providing a comprehensive guide for those who want to know more about the badges and emblems of the armed forces of the Empire and of the auxiliary services, and it is obvious, from a perusal of its 346 illustrations of badges and emblems and 134 thumbnail histories, that it has accomplished its aim in an excellent manner.

It is a splendid sixpennyworth.

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### Notices.<sup>1</sup>

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#### **SULPHANILAMIDE POWDER (BOOTS).**

BOOTS PURE DRUG Co. supply Sulphanilamide Powder as a local application in the treatment of wound infections. From 5 to 15 grammes of sulphanilamide are incorporated into the depths of the wound at the time of débridement to prevent the spread of bacteria in and around the wound, the amount of powder used depending on the extent of the trauma. Sulphanilamide Powder (Boots) is supplied in cartons containing 10 packets of 15 grammes, 7s. 6d. Subject to 15 per cent discount to the medical profession.

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#### **"WELLCOME" BRAND DELAY INSULIN.**

WE are informed that the "Wellcome" Brand Delay Insulin is being issued by Burroughs Wellcome & Co. It is an insulin preparation with a prolonged blood-sugar-lowering action, available in a strength of 40 international units per c.c. An additional strength of 80 units per c.c. will be available at an early date. The product is issued in boxes of five c.c. phials containing a solution of protamine insulin, accompanied by a phial of sodium phosphate buffer solution, which, when mixed with the protamine insulin solution, produces a freshly-precipitated suspension ready for subcutaneous injection. While the suspension is stated to be stable for a limited period only, the unmixed solution remains of full unit value for eighteen months.

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<sup>1</sup> These notices are for the purpose of acquainting officers with the latest developments in therapeutics, but do not imply that the preparations mentioned have been added to the list of authorized drugs.

## INDEX TO VOLUME LXXV.

C.N. = Clinical and other Notes.

C.L. = Current Literature.

	PAGE		PAGE
Alimentation, the mystery of .. ..		Blast from high explosive .. C.L.	339
Editorial .. ..	108	Boots, regulation Army steel helmet and, modification of the, by Dr. K. Vernon Bailey .. ..	160
Ambulance train, the organization and running of an, by Major C. C. H. Chavasse .. ..	227	Bourke, Lieutenant-Colonel J. F., the Indian Hospital Corps .. ..	84
Anaerobic infections, the treatment of, with sulphapyridine and with immune sera and the problem of synergic action .. .. Editorial	38	<i>Br. melitensis</i> infection in the Maltese goat .. .. C.L.	338
Anderson, Lieutenant-Colonel J. C., a case of double intussusception of the small gut .. .. C.N.	266	Burns .. .. C.L.	132
Anderson, Lieutenant-Colonel, J. C., two cases of osteochondritis dis- secans .. .. C.N.	324	Cantlie, Colonel N., an analysis of knee- joint operations .. ..	69, 141
Anderson, Major W. M. E., the tech- nique of virus culture on chorio- allantoic membrane in military laboratories .. ..	211	Caute, Major E. H. C., injuries of the jaws and dietary treatment .. ..	289
Antityphoid vaccine given prophylac- tically by the subcutaneous route in man and animals, the effect of the dose of .. .. C.L.	128	C.C.S., life in a, during the Great War, by Lieutenant-Colonel L. T. Challenor Echoes of the Past .. ..	53
Appendicitis, acute, general periton- itis following, the treatment of, by Captain A. J. Clyne .. ..	16	Cerebral influenza simulating early cere- brospinal meningitis, by Lieutenant G. N. Pattison .. .. C.N.	388
Arterial ligature, effects of, on the vasomotor system .. .. C.L.	336	Cerebrospinal fever, analysis of 124 cases, by Lieutenant-Colonel R. W. Cushing .. ..	301
Atkins, Lieutenant-Colonel R. R. G., practical hints on the treatment of war injuries in forward areas .. ..	152	Challenor, Lieutenant-Colonel L. T., life in a C.C.S. during the Great War Echoes of the Past .. ..	53
Avulsion of stomach from duodenum, by Major Ian Fraser .. .. C.N.	383	Chavasse, Major C. C. H., the organiza- tion and running of an ambulance train .. ..	227
Bailey, Dr. K. Vernon, modification of the regulation Army steel helmet and boots .. ..	160	Chemical warfare — gas cleansing centres, first-aid posts, and their counterpart in the field, by Captain W. A. Robinson .. .. C.N.	114
Bardhan, Captain P. N., a case of serum sickness .. .. C.N.	120	Choriomeningitis, lymphocytic, with report of a case, by Dr. G. M. Find- lay, Major C. H. Stuart-Harris and Dr. F. O. MacCallum .. ..	8
Barker, Major E. Mason, a case of pneumonia with an eosinophilia developing after M & B 693 .. C.N.	123	Clark, Major J. M. P., some observa- tions upon the work of a mobile surgical team .. ..	223
Beef, chilled, investigations on micro- bial contamination acquired in the meatworks .. .. C.L.	129	Clewer, Colonel D., military hospitals— choice of site and design .. ..	209
Bennett, Major J. A., a case of meningo- coccal conjunctivitis .. .. C.N.	264	Clyne, Captain A. J., the treatment of general peritonitis following acute appendicitis .. ..	16

	PAGE		PAGE
Conjunctivitis, meningococcal, a case of, by Major J. A. Bennett .. C.N.	264	Field ambulance by road movement on convoy, by Major R. A. Stephen .. C.N.	189
Cowell, Colonel E. M., the "M" box table .. .. C.N.	122	Findlay, Dr. G. M., Major C. H. Stuart-Harris and Dr. F. O. MacCallum, lymphocytic choriomeningitis with report of a case .. ..	8
Crew, Lieutenant-Colonel F. A. E., War and ourselves .. ..	367	Food .. .. Editorial	178
Cushing, Lieutenant-Colonel R. W., cerebrospinal fever, analysis of 124 cases .. ..	301	Fraser, Major Ian, avulsion of stomach from duodenum .. .. C.N.	383
Cystoscopic examinations, posture during. Description of a new pattern leg support, by Dr. John Everidge C.N.	387	Gas cleansing centres, first-aid posts, and their counterpart in the field, by Captain W. A. Robinson .. C.N.	114
Dermatological division, clinical notes from a, by Major R. M. B. Mackenna	295	Gas cleansing centres, first-aid posts, and their counterpart in the field, letter from Lieutenant - Colonel J. H. C. Walker .. ..	278
Dermatology in war-time, by Colonel John T. Ingram .. ..	78	Gas gangrene .. .. Editorial	316
Dermatology in war-time, letter from Lieutenant-Colonel T. E. Osmond ..	277	General Hospital in the field, teething troubles of a, by Colonel S. G. Walker	358
Dietary treatment, injuries of the jaws and, by Major E. H. C. Caute ..	289	Gimlette, Major G. T., a case of dislocation of the neck .. .. C.N.	261
Dislocation of the neck, a case of, by Major G. T. Gimlette .. C.N.	261	Goat, Maltese, <i>Br. melitensis</i> infection in the .. .. C.L.	338
ECHOES OF THE PAST :—		Gonorrhœa, intensive treatment of, with M & B 693, letter from Major J. M. Officer .. ..	209
Life in a C.C.S. during the Great War, by Lieutenant - Colonel L. T. Challenor .. ..	53	Gonorrhœa, treatment of, with the sulphonamide group of drugs, by Lieutenant-Colonel H. G. Winter ..	1
Notes on the Medical Services during the civil war and the Interregnum, 1642-1660, by the late Lieutenant-Colonel G. A. Kempthorne ..	192	Guyer, Major R. B., radiographic tube-stand for use with a field service X-ray outfit .. .. C.N.	50
EDITORIALS :—		Handicraft for soldiers. Relieving period of convalescence .. ..	253
Food .. ..	178	Healey, Major C. W., water difficulties in England .. .. C.N.	119
Gas gangrene .. ..	316	Helmet, steel, and boots, regulation Army, modification of the, by Dr. K. Vernon Bailey .. ..	160
Lighting in Factories and ventilation during the black-out .. ..	378	High explosive, blast from .. C.L.	339
Prevention of tetanus .. ..	321	Hospital, General, in the field, teething troubles of a, by Colonel S. G. Walker	358
Studies in nutrition .. ..	255	Hospitals, military—choice of site and design, by Major P. N. Walker-Taylor .. ..	101
The mystery of alimentation ..	108	Hospitals, military—choice of site and design, letter from Colonel D. Clewer	209
The treatment of anaerobic infections with sulphapyridine and with immune sera and the problem of synergic action .. ..	38		
Enemy troop carriers .. ..	58		
Everidge, Dr. John, posture during cystoscopic examinations. Description of a new pattern leg support C.N.	387		
Eves, Captain (Quartermaster) J. G., duties of a Quartermaster's Department in peace.. ..	25, 94		

	PAGE		PAGE
Incorporated Soldiers' and Sailors' Help Society, Lord Roberts Memorial Workshops, letter from Admiral of the Fleet Sir Roger Keyes .. ..	279	Lung, contusion of the, following an injury, by Major P. F. Palmer C.N.	326
Indian Hospital Corps, by Lieutenant-Colonel J. F. Bourke.. ..	84	Lung, massive collapse of the, by Major P. F. Palmer .. .. C.N.	48, 332
Infected wounds, biological aspect of .. .. C.L.	131	Lymphocytic choriomeningitis with report of a case, by Dr. G. M. Findlay, Major C. H. Stuart-Harris and Dr. F. O. MacCallum .. ..	8
Influenza, cerebral, simulating early cerebrospinal meningitis, by Lieutenant G. N. Pattison .. C.N.	388	MacCallum, Dr. F. O., Dr. G. M. Findlay and Major C. H. Stuart-Harris, lymphocytic choriomeningitis with report of a case .. ..	8
Ingram, Colonel John T., dermatology in war-time .. ..	78	Mackay-Dick, Captain J., notes on an interesting case .. .. C.N.	182
Injuries, war, in forward areas, practical hints on the treatment of, by Lieutenant-Colonel R. R. G. Atkins .. ..	152	Mackenna, Major R. M. B., Clinical notes from a dermatological division	295
Interesting case, notes on an, by Captain J. Mackay-Dick .. .. C.N.	182	Maltese goat, <i>Br. militensis</i> infection in the .. .. C.L.	338
Intussusception, double, of the small gut, a case of, by Lieutenant-Colonel J. C. Anderson .. .. C.N.	266	Martin, Major T. D. M., a method of carrying Thomas' splints in motor ambulances .. .. C.N.	47
Jaws, injuries of the, and dietary treatment, by Major E. H. C. Caute	289	"M" box table, by Colonel E. M. Cowell .. .. C.N.	122
Jeffrey, Major J. S., treatment of war wounds in France, May-June, 1940..	345	Medical Research Council, War Memorandum No. 1. The treatment of wound shock .. ..	243
Juler, Colonel Frank, military ophthalmology .. ..	281	Meningococcal conjunctivitis, a case of, by Major J. A. Bennett .. C.N.	264
Kempthorne, the late Lieutenant-Colonel G. A., notes on the medical services during the civil war and the Interregnum, 1642-1660 .. ..	192	Military hospitals—choice of site and design, by Major P. N. Walker-Taylor .. ..	101
Keyes, Admiral of the Fleet, Sir Roger, Incorporated Soldiers' and Sailors' Help Society, Lord Roberts Memorial Workshops.. Correspondence	279	Military hospitals—choice of site and design, letter from Colonel D. Clewer	209
Knee-joint operations, an analysis of, by Colonel N. Cantlie .. ..	69, 141	Milk—checking the efficiency of pasteurization .. .. C.L.	131
Lambert, Major D. P., a note on the treatment of minor sepsis .. C.N.	117	Milk—the phosphatase test for control of efficiency of pasteurization C.L.	130
Leg support, description of a new pattern of. Posture during cystoscopic examinations, by Dr. John Everidge .. .. C.N.	387	Mobile surgical team, some observations upon the work of a, by Major J. M. P. Clark .. ..	223
Lighting in factories and ventilation during the black-out .. Editorial	378	Morrison, Captain R. J. G., two cases of undulant fever treated with sulphanilamide .. .. C.N.	45
London, a study of war-time mortality in : the first seven months .. C.L.	337	Murphy, Lieutenant-Colonel (Quartermaster) D. M., description of the "sling seat" .. .. C.N.	268
		Muscles, pectoral, congenital absence of, by Major F. M. Richardson C.N.	48
		NOTICES :—	
		Aminophylline .. ..	138
		Bromethol .. ..	140
		Dagenan—M & B 693 .. ..	280

	PAGE		PAGE
NOTICES— <i>cont.</i>		Protection, personal, in the field, a suggested method of obtaining, by Major H. Temkin .. .. C.N.	265
Hexobarbitone .. .. .	139	Psychology and clinical practice, by Major G. de M. Rudolf .. ..	310
"Hypoloid" Digoxin and Normal Saline (Burroughs Wellcome and Co.) .. .. .	344	Quartermaster's Department in peace, duties of a, by Captain (Quartermaster) J. G. Eves .. ..	25, 94
Isaflav (Boots) .. .. .	67	Radiographic tubestand for use with a field service X-ray outfit, by Major R. B. Guyer .. .. . C.N.	50
Kramsol .. .. .	210	REVIEWS :—	
Methedrine .. .. .	140	A catechism of air raid precautions, fifth edition, by Norman Hammer .. .. .	207
Proseptasine and soluseptasine ..	139	Acute infectious diseases, third edition, by J. D. Rolleston and G. W. Ronaldson .. .. .	392
Rutonal .. .. .	139	Aids to medical diagnosis, fifth edition, by Arthur J. Whiting and G. E. Frederick Sutton .. ..	135
Soñeryl .. .. .	138	Aids to psychiatry, by W. S. Dawson	135
Sulphanilamide powder (Boots) ..	395	Badges and emblems of the Service	395
"Tabloid" phenobarbitone and bromide .. .. .	210	Blood groups and blood transfusion, by Alexander S. Wiener .. ..	277
Urapac .. .. .	280	Clinical practice in infectious diseases, by E. H. R. Harries and M. Mitman .. .. .	342
"Wellcome" brand delay insulin ..	395	Green's manual of pathology, sixteenth edition, by H. W. C. Vines .. .. .	207
Nutrition, studies in .. .. Editorial	255	Groves & Brickdale's Textbook for Nurses, sixth edition, by E. W. Hey Groves and J. A. Nixon ..	394
Officer, Major J. M., intensive treatment of gonorrhœa with M & B 693 ..		Insect pests, by W. Clunie Harvey ..	133
Correspondence	209	Landmarks and surface markings of the human body, eighth edition, by L. Bathe Rawling .. ..	208
Ophthalmology, military, by Colonel Frank Juler .. .. .	281	Leprosy, second edition, by Sir Leonard Rogers and Ernest Muir ..	137
Osmond, Lieutenant-Colonel T. E., dermatology in war-time .. ..		Medical diseases of war, by Sir Arthur Hurst .. .. .	204
Correspondence	277	Modern treatment in general practice. Year Book 1940. Edited by Cecil P. G. Wakeley .. .. .	135
Osteochondritis dissecans, two cases of, by Lieutenant-Colonel J. C. Anderson C.N.	324	Official history of the Australian A.M.S. in the War of 1914-1918, vol. ii. The Western Front, by Colonel A. G. Butler .. ..	275
Palmer, Major P. F., contusion of the lung following an injury .. C.N.	326		
Palmer, Major P. F., massive collapse of the lung .. .. . C.N.	48, 332		
Palmer, Major P. F., notes on a case of tetanus .. .. . C.N.	271		
Pasteurization, checking the efficiency of .. .. . C.L.	131		
Pattison, Lieutenant G. N., cerebral influenza simulating early cerebrospinal meningitis .. .. C.N.	388		
Pectoral muscles, congenital absence of, by Major F. M. Richardson .. C.N.	48		
Peritonitis, general, the treatment of, following acute appendicitis, by Captain A. J. Clyne .. .. .	16		
Pneumonia with an eosinophilia developing after M & B 693, a case of, by Major E. Mason Barker .. C.N.	123		
Posture during cystoscopic examinations, description of a new pattern of leg support, by Dr. John Everidge C.N.	387		

	PAGE		PAGE
REVIEWS— <i>cont.</i>		Steel helmet and boots, regulation	
Organization, strategy and tactics		Army, modification of the, by Dr.	
of the A.M.S. in War, second		K. Vernon Bailey .. .. .	160
edition, by Lieutenant-Colonel		Stephen, Major R. A., road movement	
T. B. Nicholls .. .. .	343	by field ambulance on convoy C.N.	189
Psychology and psychotherapy,		Stomach, avulsion of, from duodenum,	
fourth edition, by William Brown	136	by Major Ian Fraser .. .. .	383
Shell shock in France, 1914-1918, by		Stuart-Harris, Major C. H., Dr. G. M.	
Charles S. Myers .. .. .	64	Findlay and Dr. F. O. MacCallum,	
The soldier's heart and the effort syn-		lymphocytic choriomeningitis with	
drome, second edition, by Sir		report of a case .. .. .	8
Thomas Lewis .. .. .	394	Sulphonamide derivatives, memoran-	
Textbook of public health, tenth		dum concerning the use of .. .. .	173, 377
edition, by W. F. Frazer and C. O.		Sulphonamide packs, treatment of war	
Stallybrass .. .. .	136	wounds by .. .. .	C.L. 202
The louse, by Patrick A. Buxton ..	134	Sulphur and chemotherapy .. .. .	C.L. 132
The Medical Annual, 1940. Edited		Surgery of infected wounds .. .. .	C.L. 62
by H. Letheby Tidy and A.		Surgical team, mobile, some observa-	
Rendle Short .. .. .	340	tions upon the work of a, by Major	
Triangular bandaging without		J. M. P. Clark .. .. .	223
words .. .. .	208	Table, the "M" box, by Colonel E. M.	
Tuberculosis of the upper respira-		Cowell .. .. .	C.N. 122
tory tracts, by F. C. Ormerod ..	65	Teeth, the structure of, as shown by	
Twenty questions on gonorrhœa, U.S.		X-ray examination .. .. .	C.L. 274
Public Health Service .. .. .	394	Temkin, Major H., a suggested method	
Wide field X-ray treatment, by		of obtaining personal protection in	
S. Gilbert Scott .. .. .	66	the Field .. .. .	C.N. 265
Richardson, Major F. M., congenital		Tetanus, notes on a case of, Major P. F.	
absence of pectoral muscles .. C.N.	48	Palmer .. .. .	C.N. 271
Rickettsial infections, immunization		Tetanus, prevention of .. Editorial	321
against .. .. .	C.L. 273	Thomas' splints, a method of carrying,	
Road movement by field ambulance		in motor ambulances, by Major	
on convoy, by Major R. A. Stephen		T. D. M. Martin .. .. .	C.N. 47
C.N. 189		Train, ambulance, the organization and	
Robinson, Captain W. A., gas cleans-		running of an, by Major C. C. H.	
ing centres, first-aid posts, and their		Chavasse .. .. .	227
counterpart in the field .. C.N.	114	Troop carriers, enemy .. .. .	58
Rudolf, Captain G. de M., the un-		Tuberculin tests in cattle. Observa-	
certified chronic patient .. .. .	236	tions on the intradermal tuberculin	
Rudolf, Major G. de M., psychology		test in cattle with special reference	
and clinical practice .. .. .	310	to the use of synthetic medium tuber-	
Sepsis, minor, a note on the treatment		culin .. .. .	C.L. 126
of, by Major D. P. Lambert .. C.N.	117	Tube stand, radiographic, for use with a	
Serum sickness, a case of, by Captain		field service X-ray outfit, by Major	
P. N. Bardhan .. .. .	C.N. 120	R. B. Guyer .. .. .	C.N. 50
Shock, wound, the treatment of, War		Uncertified chronic patient, the, by	
Memorandum No. 1 Medical Research		Captain G. de M. Rudolf .. .. .	236
Council .. .. .	243	Undulant fever treated with sulphanil-	
"Sling seat," description of the, by		amide, two cases of, by Captain	
Lieutenant-Colonel (Quartermaster)		R. J. G. Morrison .. .. .	C.N. 45
D. M. Murphy .. .. .	C.N. 268		

	PAGE		PAGE
Venereal diseases in war-time, the problem of. <i>Health and Empire</i> ..		Water difficulties in England, by Major C. W. Healey .. .. .	C.N. 119
	C.L. 125	Water of high inorganic salt content, experiments concerned with the disinfection of, with special reference to sea-water .. .. .	C.L. 127
Ventilation and lighting in factories during the black-out ..	Editorial 378	Water, polluted, some functions of bacteria in the purification of ..	C.L. 390
Virus culture on chorio-allantoic membrane in military laboratories, the technique of, by Major W. M. E. Anderson .. .. .	211	Water supplies, chlorinated, a study of floc-forming organisms in ..	C.L. 391
Walker, Colonel S. G., teething troubles of a General Hospital in the field ..	358	Winter, Lieutenant-Colonel H. G., further notes on the treatment of gonorrhœa with the sulphonamide group of drugs .. .. .	1
Walker, Lieutenant-Colonel J. H. C., gas cleansing centres, first aid posts, and their counterpart in the field		Wound shock, the treatment of, War Memorandum No. 1, Medical Research Council .. .. .	243
	Correspondence 278	Wounds, infected, biological aspect of ..	C.L. 131
Walker-Taylor, Major P. N., military hospitals—choice of site and design ..	101	Wounds, infected, surgery of ..	C.L. 62
War and ourselves, by Lieutenant-Colonel F. A. E. Crew .. ..	367	Wounds, war, of the abdomen ..	C.L. 333
War injuries in forward areas, practical hints on the treatment of, by Lieutenant-Colonel R. R. G. Atkins ..	152	Wounds, war, treatment of, by sulphonamide packs .. ..	C.L. 202
War-time mortality in London, a study of: the first seven months ..	C.L. 337	Wounds, war, treatment of, in France, May-June, 1940, by Major J. S. Jeffrey .. .. .	345



# JOURNAL OF THE ROYAL ARMY MEDICAL CORPS

## Corps News.

DECEMBER, 1940.

### EXTRACTS FROM THE "LONDON GAZETTE."

*Nov. 22.*—The KING has approved the undermentioned appointments :—

To be Hon. Physicians to The King :—

Col. D. M. McWhae, C.M.G., C.B.E., V.D., M.D., M.B., Ch.B., M.R.C.P., F.R.A.C.P., F.R.C.P., Austr. Army Med. Corps.

Col. F. T. Bowerbank, O.B.E., E.D., M.D., F.R.C.P. (Edin.), F.R.A.C.P., New Zealand Med. Corps.

To be Hon. Surgeons to The King :—

Col. R. W. Whiston-Walsh, D.S.O., V.D., M.B., Ch.B., F.R.A.C.S., Austr. Army Med. Corps.

Col. K. McCormick, D.S.O., E.D., M.B., Ch.B., F.R.C.S. (Eng.), New Zealand Med. Corps.

*Oct. 18.*—Maj.-Gen. R. C. Priest, M.D., F.R.C.P., K.H.P. (10473) to be Insp. of Med. Servs., and to temp. relinquish the appt. of Consulting Physician to the Army. Aug. 7, 1940.

Col. B. Biggar, M.B., F.R.C.S. (6833) (late R.A.M.C.), is placed on the h.p. list on account of ill-health. Nov. 17, 1940.

Lt.-Col. (temp. Col.) W. P. Croker, M.B. (8071), from R.A.M.C., to be Col. Nov. 17, 1940, with seniority July 13, 1938.

Maj. & Bt. Lt.-Col. (temp. Lt.-Col.) G. H. Haines, M.C. (23239), to be Lt.-Col. Nov. 17, 1940.

*Nov. 5.*—Col. I. Murphy, D.S.O. (11089) (late R.A.M.C.), retires on ret. pay. Nov. 5, 1940.

Lt.-Col. J. Rowe, M.C., M.B. (8101), from R.A.M.C., to be Col. Nov. 5, 1940, with seniority June 15, 1938.

Maj. (temp. Lt.-Col.) E. M. Townsend, M.C. (27900), to be Lt.-Col. Nov. 5, 1940.

Maj. J. F. Bourke, M.C. (1185), retires on ret. pay on account of ill-health. Nov. 6, 1940.

*Nov. 15.*—Maj. F. A. L'Estrange, M.B. (14362), retires on ret. pay on account of ill-health. Oct. 28, 1940.

Lt.-Col. J. E. M. Boyd, M.C. (5239), ret. pay (late R.A.M.C.), at his own request, reverts to the rank of Maj., whilst empld. during the present emergency. Oct. 8, 1940.

The undermentioned Capt. (Short Serv. Offs.) are apptd. to perm. commns., retaining their present seniority :—

Sept. 1, 1940 :—

J. L. Gordon (65315).

Sept. 27, 1940 :—

S. J. Meyersohn, M.B. (66470).

Oct. 5, 1940 :—

(Temp. Maj.) G. C. Dansey-Browning (65323).

Oct. 8, 1940 :—

A. Gleave, M.B. (65314).

Oct. 24, 1940 :—

(Temp. Maj.) W. N. J. Clarke, M.B. (66474).

(Temp. Maj.) H. N. Perkins, M.B. (66484).

J. D. Cruikshank, M.B. (66478).

M. P. H. Sayers, M.B. (66473).

(Temp. Maj.) D. P. Stevenson (66486).

G. A. E. Harman, M.B. (66481).

Oct. 27, 1940 :—

A. H. T. F. Fullerton (65324).

Nov. 1, 1940 :—

A. M. Pugh, M.B. (65319).

J. H. Taylor, M.B. (57334).

*Nov. 26.*—Col. W. L. Webster, M.B. (8713) (late R.A.M.C.), retires on ret. pay on account of ill-health. Nov. 27, 1940.

Lt. Col. (actg. Col.) E. W. Wade (8131), D.S.O., O.B.E., M.D., from R.A.M.C., to be Col. Nov. 27, 1940, with seniority July 27, 1938.

*Nov. 18.*—*Short Service Commissions.*—The appt. of the undermentioned Lts. are antedated under the provs. of Art. 39, Royal Warrant for Pay and Promotion, 1940 :—

T. P. Howkins (51295) to July 20, 1938, but not to carry pay and allces. prior to July 20, 1939.

G. E. Gray, M.B. (66505) to Sept. 1, 1938, but not to carry pay and allces. prior to Sept. 1, 1939.

The undermentioned Lts. to be Capt. :—  
July 20, 1940 :—

T. P. Howkins (51295), with seniority July 20, 1939, and precedence next below Capt. S. J. Nathan. (Substituted for the notifs. in the Gazette of Aug. 15, 1939, and July 19, 1940.) Sept. 1, 1940 :—

G. E. Gray, M.B. (66505) with seniority Sept. 1, 1939, and precedence next below Capt. G. G. Black, M.B.

H. F. L. Gallaher, M.B. (99104).

H. L. Connor, M.B. (99319).

I. D. Paterson, M.B. (99318).

I. W. H. Mansfield (99854).

R. S. McGeorge, M.B. (99322).

D. G. Howatson (99321).

D. A. Bird (99103).

C. D. Salmond (99323).

*Oct. 22.—Short Service Commission.*—The appt. of Lt. D. B. Jagger, M.B. (99110), is antedated to Jan. 14, 1939, under the provs. of Art. 39, Royal Warrant for Pay and Promotion, 1940, but not to carry pay and allices. prior to Sept. 3, 1939.

Lt. D. B. Jagger, M.B. (99110), to be Capt. Sept. 3, 1940, with seniority Jan. 14, 1940, and precedence next below Capt. R. A. R. Topping (90097).

*Oct. 25.*—The undermentioned Capts. to be Majs. Oct. 1, 1940 :—

(Actg. Maj.) I. H. C. Morton, M.B. (49754).

(Temp. Maj.) W. R. M. Drew, M.B., M.R.C.P. (52405).

(Temp. Maj.) A. Macdonald, M.B. (52004).

*Short Service Commissions.*—The appts. of Lts. M. F. X. Slattery, M.D. (78911); J. A. Allen, M.B. (100136); W. MacK. McLennan, M.B. (99599); and G. M. Barling, M.B. (99317); are ante-dated to Sept. 5, 1938; Oct. 1, 1938; Apr. 10, 1939; and July 28, 1939, respectively, under the provs. of Art. 39, Royal Warrant for Pay and Promotion, 1940, but not to carry pay and allices. prior to Sept. 5, 1939; Sept. 4, 1939; Sept. 3, 1939; and Sept. 3, 1939, respectively.

The undermentioned Lts. to be Capts. :—  
M. F. X. Slattery, M.D. (78911), Sept. 5, 1940, with seniority Sept. 5, 1939.

J. A. Allen, M.B. (100136), Sept. 4, 1940, with seniority Oct. 1, 1939, and precedence next below Capt. W. B. Foster, M.B. (90093).

W. A. Groom (49674), Sept. 3, 1940, with seniority Nov. 1, 1939, and precedence next below Capt. R. A. Daly (78707).

F. J. Ingham, B.M. (78910), Sept. 2, 1940, with seniority Nov. 1, 1939, and precedence next below Capt. W. A. Groom (49674).

W. MacK. McLennan, M.B. (99599), Sept. 3, 1940, with seniority Apr. 10, 1940.

G. M. Barling, M.B. (99317), Sept. 3, 1940, with seniority July 28, 1940.

N. E. O'Neill, M.B. (94922), Sept. 4, 1940.

*Nov. 22.—Short Service Commissions.*—The appt. of Lt. G. F. Edwards, M.B. (78766), is antedated to Nov. 1, 1937, under the provs. of Art. 39, Royal Warrant for Pay and Promotion, 1940, but not to carry pay and allices. prior to Nov. 1, 1938.

Lt. G. F. Edwards, M.B. (78766), to be Capt. Nov. 1, 1939, with seniority Nov. 1,

1938, and precedence next below Capt. J. J. Justice, M.B. (78770). (Substituted for the notifi. in the *Gazette* of Nov. 28, 1939.)

*Nov. 8.—Temporary Commission.*—Lt F. F. Langridge (100497) is dismissed the Service by sentence of a Gen. Court Martial. Oct. 12, 1940.

*Nov. 26.—Short Service Commission.*—John Pardey Crawford (154902) to be Lt. (on prob.). Nov. 1, 1940.

### Regular Army Reserve of Officers.

*Oct. 18.*—Maj. J. H. M. Frobisher, O.B.E., M.B. (14046) having attained the age limit of liability to recall ceases to belong to the Res. of Off. Oct. 11, 1940.

The undermentioned Capts. to be Bt. Majs. under the provs. of Art. 168, Royal Warrant for Pay and Promotion, 1940 :—

(Temp. Maj.) R. C. Aitchison, M.B. (18351), Sept. 2, 1939.

J. W. Cannon, M.B. (18347), Oct. 11, 1939.

(Temp. Maj.) L. Buckley, M.B. (51524), Sept. 2, 1940.

*Oct. 22.*—Capt. F. H. Woods (15674) to be Bt. Maj. July 11, 1940, under the provs. of Art. 168, Royal Warrant for Pay and Promotion, 1940.

Capt. E. Davies, M.B. (51030), ceases to belong to the Res. of Off. on account of ill-health. Oct. 21, 1940.

*Oct. 25.*—Capt. T. R. Snelling (14378), to be Bt. Maj. Apr. 19, 1940, under the provs. of Art. 168, Royal Warrant for Pay and Promotion, 1940.

*Oct. 29.*—Capt. J. E. Foley (5075), to be Bt. Maj. Sept. 10, 1939, under the provs. of Art. 168, Royal Warrant for Pay and Promotion, 1940.

Capt. J. A. Tolmie (100836), is dismissed the Service by sentence of a Gen. Court Martial. Oct. 23, 1940.

*Nov. 5.*—Capt. A. G. P. Hardwick, M.C. (15643), to be Bt. Maj. Apr. 14, 1940, under the provs. of Art. 168, Royal Warrant for Pay and Promotion, 1940.

*Nov. 12.*—The undermentioned Cols. (late R.A.M.C.), having already attained the age-limit of liability to recall, cease to belong to the Res. of Off. on ceasing to be re-empld :—

F. A. McCammon, O.B.E., M.C., M.B., (5436), July 27, 1940.

H. B. Kelly, D.S.O., M.B. (10517), Aug. 11, 1940.

F. C. Sampson, D.S.O., M.B. (11035), Aug. 11, 1940.

Capt. A. K. Forbes, M.C., M.B., to be Bt. Maj. Nov. 18, 1940, under the provs. of Art. 168, Royal Warrant for Pay and Promotion, 1940.

## TERRITORIAL ARMY.

*Nov. 8.*—Capt. C. S. France (40904), from Manch. R., to be Capt. *Oct. 16, 1940*, with seniority *Feb. 21, 1936*.

William Dally Richardson, M.B. (65477), from T.A. Gen. List, to be Lt. *Sept. 29, 1939*.

Capt. (Qr.-Mr.) F. J. L. Gribble (111276) retires. *Oct. 25, 1940*.

Capt. G. Carruth, M.B. (65602), relinquishes his commn. on account of ill-health. *Oct. 28, 1940*.

Capt. N. G. Clements (72463) relinquishes his commn. on account of ill-health. *Oct. 31, 1940*.

*Nov. 19.*—Lt. (War Subs. Capt.) R. C. B. Barbor, M.B. (79695), relinquishes his commn. on account of ill-health. *Nov. 7, 1940*.

*Nov. 29.*—Lt. M. F. Smith, from The Camb. R., to be Lt. *Apr. 22, 1940*.

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## THE ARMY DENTAL CORPS.

*Oct. 25.*—Maj. (temp. Lt.-Col.) T. Edwards (26775), to be Lt.-Col. *Oct. 5, 1940*.

*Nov. 12.*—Capt. A. H. Kay (34527), to be Bt. Maj. *Sept. 1, 1939*.

*Nov. 26.*—Capt. W. E. Duckworth, B.D.S. (47985), to be Maj. *Nov. 11, 1940*.

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## QUEEN ALEXANDRA'S IMPERIAL MILITARY NURSING SERVICE.

*Oct. 18.*—Staff Nurse Miss J. K. Sedgwick, terminates her appt. *Oct. 2, 1940*.

*Oct. 22.*—The undermentioned resign their appts. :—

Sister Miss M. S. Knight. *Aug. 31, 1940*.

Staff Nurse Miss M. Hopkins. *Oct. 1, 1940*.

*Nov. 22.*—Staff Nurse Miss M. D. Etches resigns her appt. *Nov. 16, 1940*.

*Oct. 25.*—The undermentioned Staff Nurses to be Sisters—*Jan. 3, 1940* : Miss V. D. A. Powell, with seniority next below Miss C. N. M. Murray. *Sept. 1, 1940* : Miss A. V. Fenton, Miss M. L. Loxton, Miss J. Evers, Miss L. Dodsley. *Sept. 4, 1940* : Miss J. S. Cumming, Miss J. E. Chambers, Miss M. E. Lindsay. *Sept. 5, 1940* : Miss Y. C. Carson. *Sept. 7, 1940* : Miss M. McAskie. *Sept. 8, 1940* : Miss W. Delaney, Miss M. E. Thorpe. *Sept. 9, 1940* : Miss M. J. McMahon, Miss E. A. de Garvis, Miss D. M. Jelley. *Sept. 11, 1940* : Miss G. E. Thompson, Miss R. E. Chubb, Miss B. Palmer, Miss B. M. Speak. Miss W. Kelleher, Miss M. C. Murdoch, Miss G. M. McCormack, Miss V. G. Frood, Miss J. M. Morrison. *Sept. 14, 1940* : Miss J. Hors-

fall, Miss M. V. Moloney, Miss M. K. Brown. *Sept. 19, 1940* : Miss M. E. May. *Sept. 21, 1940* : Miss C. C. Anderson. *Sept. 22, 1940* : Miss P. D. Grose. *Sept. 23, 1940* : Miss J. R. R. Brown. *Sept. 26, 1940* : Miss L. M. Egan.

*Nov. 26.*—The undermentioned Staff Nurses to be Sisters :—

Miss V. E. Cheetham. *Sept. 9, 1940*, with seniority next below Miss M. E. Thorpe.

Miss V. A. M. N. Morgan. *Sept. 10, 1940*.

Miss E. M. Coombes. *Sept. 23, 1940*.

Miss M. A. G. Cameron. *Sept. 30, 1940*.

Miss P. B. M. W. Wrangham. *Oct. 5, 1940*.

Miss B. E. Scott. *Oct. 5, 1940*.

Miss Y. M. Douglas. *Oct. 9, 1940*.

Miss J. Mitchell. *Oct. 10, 1940*.

Miss H. M. Deane. *Oct. 10, 1940*.

Miss K. N. Roberts. *Oct. 10, 1940*.

Miss M. R. C. Wells. *Oct. 19, 1940*.

*Nov. 5.*—Miss Rowan Muriel Nona Mansel to be provl. Staff Nurse. *Feb. 16, 1940*.

*Nov. 15.*—The undermentioned resign their appts. :—

Sister Miss M. Gordon. *Nov. 1, 1940*.

Staff Nurse Miss A. M. Heywood. *Nov. 14, 1940*.

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## ROYAL ARMY MEDICAL CORPS AND THE ARMY DENTAL CORPS COMFORTS GUILD.

Lady MacArthur, Mrs. Clewer and the Committee wish to thank all those who have sent subscriptions and gifts since the last issue.

It would simplify the sending of receipts if, in future, all Royal Army Medical Corps subscriptions, parcels, &c., were addressed to the Honorary Secretary, Royal Army Medical Corps and The Army Dental Corps

Comforts Guild, R.A.M.C. Headquarters Mess, Millbank, S.W.1.

The Army Dental Corps should still send their subscriptions to Mrs. Clewer, 27, Park Hill, Ealing, W.5, and parcels to the Director of Dental Services, Room 169, Hobart House, Grosvenor Place, S.W.1.

Before the end of November the Guild Funds had passed the thousand pound mark,

which was very gratifying. The chief expenses are wool for the knitters, games and other comforts. Up to the present nearly £300 has been spent in this way, and more of everything is on order.

The Committee again appeals for subscriptions from those who have not yet subscribed, and a little more from those who have. Please, too, will you send any spare playing cards and paper-covered books.

Parcels have been sent to the Orkneys and Faroe Islands. Toilet requisites, games, books and writing materials are, in the near future, to go to the Middle East. The Commands at home will shortly also receive

a first consignment; some have already done so. Transport difficulties unfortunately slow up everything.

It was decided at the last Committee Meeting that a cheque for £100 should be sent to the Red Cross, as a donation towards the cost of parcels to the men in the R.A.M.C. and A.D. Corps who are prisoners of war. A further donation will be sent as soon as funds permit. Any money which it is desired to allocate to this purpose will be set on one side.

R.A.M.C. Headquarters Mess,  
Millbank, London, S.W.1.  
December 11, 1940.

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### MILITARY WIDOWS' FUND (INDIA), (BRITISH SERVICE).

WE have been informed that notification has been received from India that the above Fund has been reopened to all Officers who

were Members of the Fund on August 25, 1939, provided they apply to the Hon. Secretary, and pay arrears of subscription.

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### DEATHS.

GIBSON.—On October 4, 1940, as the result of enemy action, Colonel A. Gibson. A correspondent writes: "The Army Dental Corps has sustained a tragic loss in the death, as the result of enemy action on October 4, 1940, of Colonel A. Gibson, Assistant Director of Dental Service. Colonel Gibson was born at Hornsea, East Yorkshire, on February 19, 1889, and qualified as a dental surgeon at the Victoria University, Manchester, in 1911. On the outbreak of the Great War he enlisted in the Royal Naval Volunteer Reserve and served with the Royal Naval Division in Gallipoli, the Islands of the Aegean Sea, and France. On August 14, 1916, he was appointed to a temporary commission as Lieutenant, General List, for duty as a dental officer attached to the 51st (Highland) Casualty Clearing Station, continuing his services in France and Belgium until the close of hostilities. Thereafter he served with the Army of Occupation on the Rhine, and later as Senior Dental Officer, Silesian Force. He received the 1914-1915 Star, General Service and Allied War Medals. Promoted to the temporary rank of Captain in 1920, he was granted a permanent commission in The Army Dental Corps two years later. After further promotion to Major in 1928, he took up the appointment of Officer-in-Charge of the Army Dental Centre at the Guards Depot, Caterham, and subsequently that of Senior Dental Officer at Woolwich. In 1935 he was promoted to the rank of Lieutenant-Colonel and in the following year he became Assistant Director of Dental Service, Eastern

Command, receiving the temporary rank of Colonel on the outbreak of the present war. Colonel Gibson joined the British Dental Association in 1917. Held in affectionate regard by all who knew him, and they are many, Arnold Gibson's splendid gifts of leadership, balanced judgment and wise counsel are a grave loss to the Corps in which he served with such distinction. He was a lover of cricket, though he was no less able to afford a full measure of his enthusiasm for The Army Dental Corps Golfing Society of which he was honorary secretary. The quiet, kindly manner in which he exercised his high administrative ability was always an inspiration to those who were privileged to serve with him. As a brother officer was heard to express 'he was a man who loved his fellow creatures.' Nothing could more vividly epitomize Arnold Gibson's fine qualities."

LEWIS.—On October 23, 1940, Lieutenant-Colonel Richard Crump Lewis, R.A.M.C., retired, of Grafton, Salcombe, S. Devon. Son of Stephen Lewis, Esq., of the Ramparts, Kinsale, Co. Cork, he was born in Kinsale on April 15, 1865, taking the L.R.C.P.I. and L.R.C.S.I. and L.M. in 1898. He was gazetted Surgeon Lieutenant A.M.D. on July 27, 1892, and promoted Surgeon Captain on July 27, 1895. Becoming Major R.A.M.C., July 27, 1904, and Lieutenant-Colonel on March 1, 1915, he retired on August 1, 1919. He served on the North Frontier of India in 1897-1898, being awarded the Medal with Clasp. In South Africa he served in Cape Colony

in 1900 and in 1902, and received the Queen's Medal with two Clasps. He served in France from May 27, 1918, till the end of the war, receiving the British War and Victory Medals.

**THOMPSON.**—In Redruth, on December 11, 1940, Colonel Albert George Thompson, C.M.G., D.S.O. Born in Islington West on May 24, 1867, he was educated at Edinburgh, where he graduated M.B. in 1891. He took the D.P.H., R.C.P.S. Edinburgh and Glasgow in 1905. Commissioned Surgeon Lieutenant July 27, 1892, he was promoted Surgeon Captain July 27, 1895, Major July 27, 1904, Lieutenant-Colonel March 1, 1915, Brevet Colonel January 1, 1919, and Substantive Colonel September 13, 1918. He retired November 15, 1919. He served in the South African Campaign in 1902, being awarded the Queen's Medal with two clasps. He served in France from 1914 till the end of the war. Five times mentioned in despatches, he was awarded a brevet of Colonel, the C.M.G., D.S.O.,

Medaille de la Reconnaissance Française en argent, 1914 Star and Clasp, British War and Victory Medals.

**WEBSTER.**—In the Middlesex Hospital, on December 1, 1940, Colonel William Leckie Webster, late R.A.M.C. (Retired). Born November 3, 1887, he took the M.B. Edinburgh, in 1910. Gazetted Lieutenant R.A.M.C., S.R., October 4, 1910, he became Lieutenant R.A.M.C., July 28, 1911. He was promoted Captain January 28, 1915, Brevet Major January 1, 1919, Substantive Major July 28, 1923, Lieutenant-Colonel May 1, 1934, and Colonel November 1, 1938, with seniority May 1, 1937. He had only retired on November 27, 1940. He served in France and Belgium from March 15, 1917, until the end of the Great War, being awarded the French War Cross, Medal of "La Solidaridad" 3rd Class, the British War and Victory Medals, and was mentioned in despatches. During the present war he served in France from January to May, 1940.

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